22.1 INTRODUCTION

The preceding chapters of this GEIS describe the World Trade Center Memorial and Redevelopment Plan (Proposed Action) and assess its expected environmental impacts in a broad range of potential impact areas. In some areas—land use, urban design, visual resources, neighborhood character, socioeconomic conditions, and energy efficiency—the Proposed Action is expected to have clear benefits. In other areas, such as historic resources, infrastructure, and hazardous materials, the Proposed Action incorporates measures to avoid any potential adverse impacts.

In some areas, however, the Proposed Action would have one or more significant adverse impacts that would require mitigation measures to avoid or reduce such impacts. Those mitigation measures, and their expected effectiveness in avoiding or reducing adverse impacts, are described in detail below.

22.2 HISTORIC RESOURCES

22.2.1 ARCHEOLOGICAL RESOURCES

Three areas of the Project Site were found to be potentially sensitive for historic period archaeological resources, as described in Chapter 5, "Historic Resources." The northeast and southeast corners of the WTC Site as well as the portion of the Southern Site between Route 9A and Washington Streets may be sensitive for historic period archaeological resources, including shaft features (such as privies, cisterns, wells, and cesspools) predating the 1850s as well as wharf and/or cribbing features. To avoid or reduce to the extent practicable potential impacts on these resources, the Proposed Action would include a Phase IB investigation. On the Southern Site, the Phase IB investigations would consist of archaeological monitoring during construction. *These commitments would also be included in the Programmatic Agreement described in section 22.2.2.*

22.2.2 HISTORIC RESOURCES

As noted in Chapter 5, "Historic Resources," the Proposed Action could have an adverse effect on a number of the remaining remnants on the World Trade Center that contribute to the WTC Site's historic significance. In order to minimize or mitigate any such effects, LMDC has proposed to enter into a Programmatic Agreement with the New York State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation that would include specific commitments with respect to the treatment or removal of such remnants and procedures for consultation with SHPO and those consulting parties who participated in the Section 106 process referred to in Chapter 5. A draft of the proposed Programmatic Agreement is included in Appendix K-7.

22.3 TRAFFIC AND PARKING

22.3.1 INTRODUCTION AND OVERVIEW OF FINDINGS

As discussed in Chapter 13A, "Traffic and Parking", the Proposed Action would result in significant traffic impacts at locations within the study area, as per the methodologies and significant traffic impact criteria contained in the *CEQR Technical Manual*. This section identifies the traffic improvements that would be needed to mitigate such impacts. Overall, standard traffic capacity and engineering improvements would be able to mitigate the vast majority of these impacts; at a few locations, impacts could be only partially mitigated or would not be able to be mitigated via standard measures, but would call for areawide traffic management strategies, which are also described in this section. Table 22-1 provides a traffic mitigation summary for years 2009 and 2015 with the at-grade arterial design for Route 9A. Figures 22-1 through 22-6 graphically illustrate the ability to mitigate impacts intersection by intersection. Details of the intersection capacity analyses and detailed specification of all traffic mitigation measures (e.g., specific signal timing changes) are provided in Appendix E.

Table 22-1
Traffic Impact Mitigation Summary

Signalized and Unsignalized Intersections	2009 AM	2009 Midday	2009 PM	2015 AM	2015 Midday	2015 PM
No Significant Impact	24	26	24	18	21	18
Mitigated Impact	15	13	16	20	14	19
Partially Mitigated or Unmitigated Impact[1]	3	3	2	4	7	5

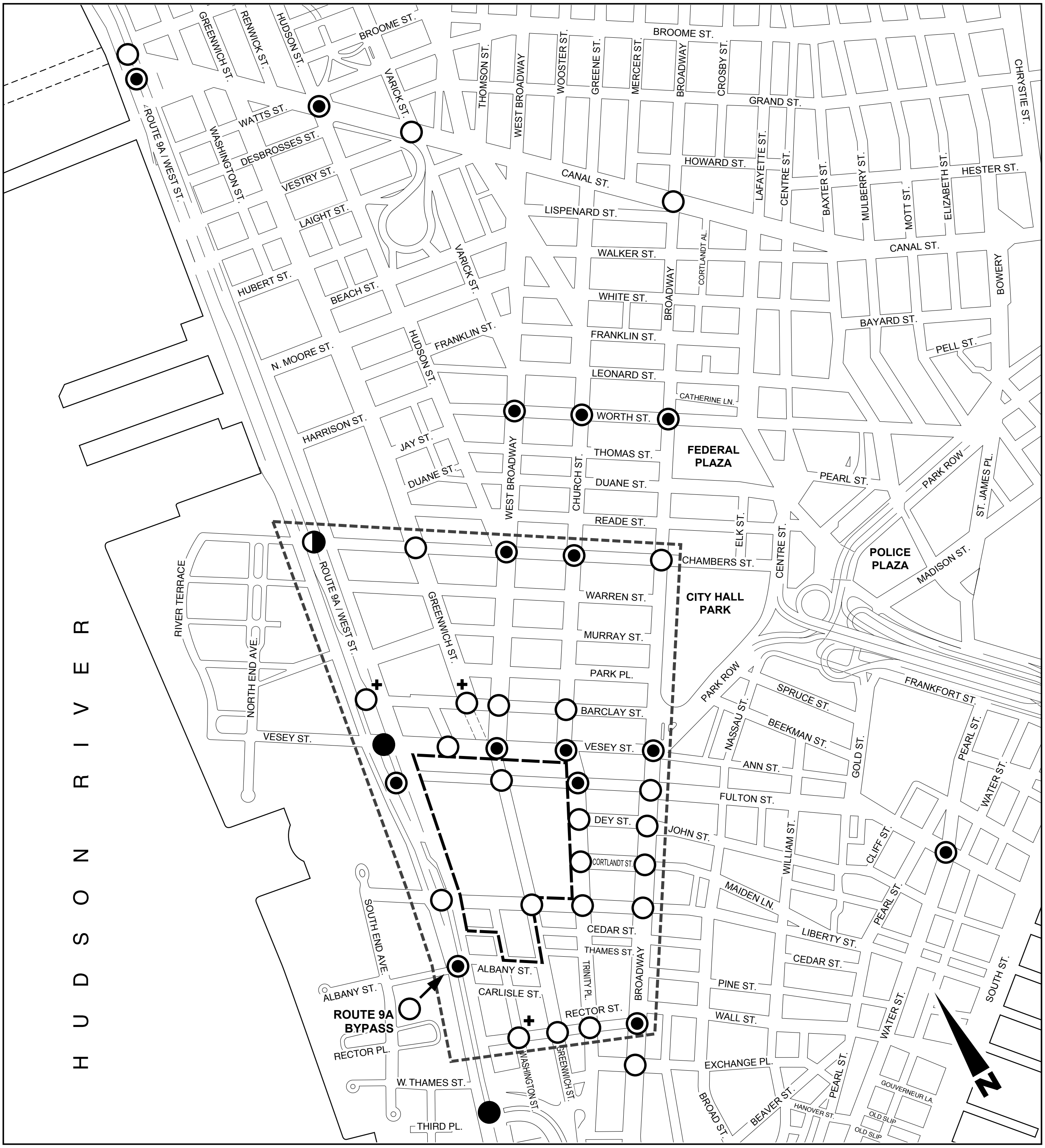
Note: [1] Would require areawide traffic management strategy.

The vast majority of locations significantly impacted by the Proposed Action could be mitigated with standard traffic engineering improvements, including:

- Signal phasing and/or timing changes;
- Prohibition of on-street parking at the approaches to a number of intersections in order to add a travel lane at the intersection;
- Enforcement of existing parking prohibitions at several locations to ensure that traffic lanes are available to moving traffic and are not blocked during key peak hours;
- Lane re-striping and lane designation changes to make more efficient use of available street widths;
- Relocating pedestrian crosswalks at key locations to minimize conflicts between vehicular and pedestrian traffic, and/or adding all-pedestrian phases at specific high pedestrian activity locations; and
- Relocating bus stops at a few key locations from the near side of the intersection to the far side of the intersection.

These measures represent the standard range of traffic capacity improvements that are available and are implemented to improve traffic conditions and mitigate impacts. Moreover, several of these measures would be applied to current conditions, temporary signal timings, and parking regulations that are currently in-place at a time when traffic volumes in the area are significantly

3.25.04



Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

Unmitigated Impact

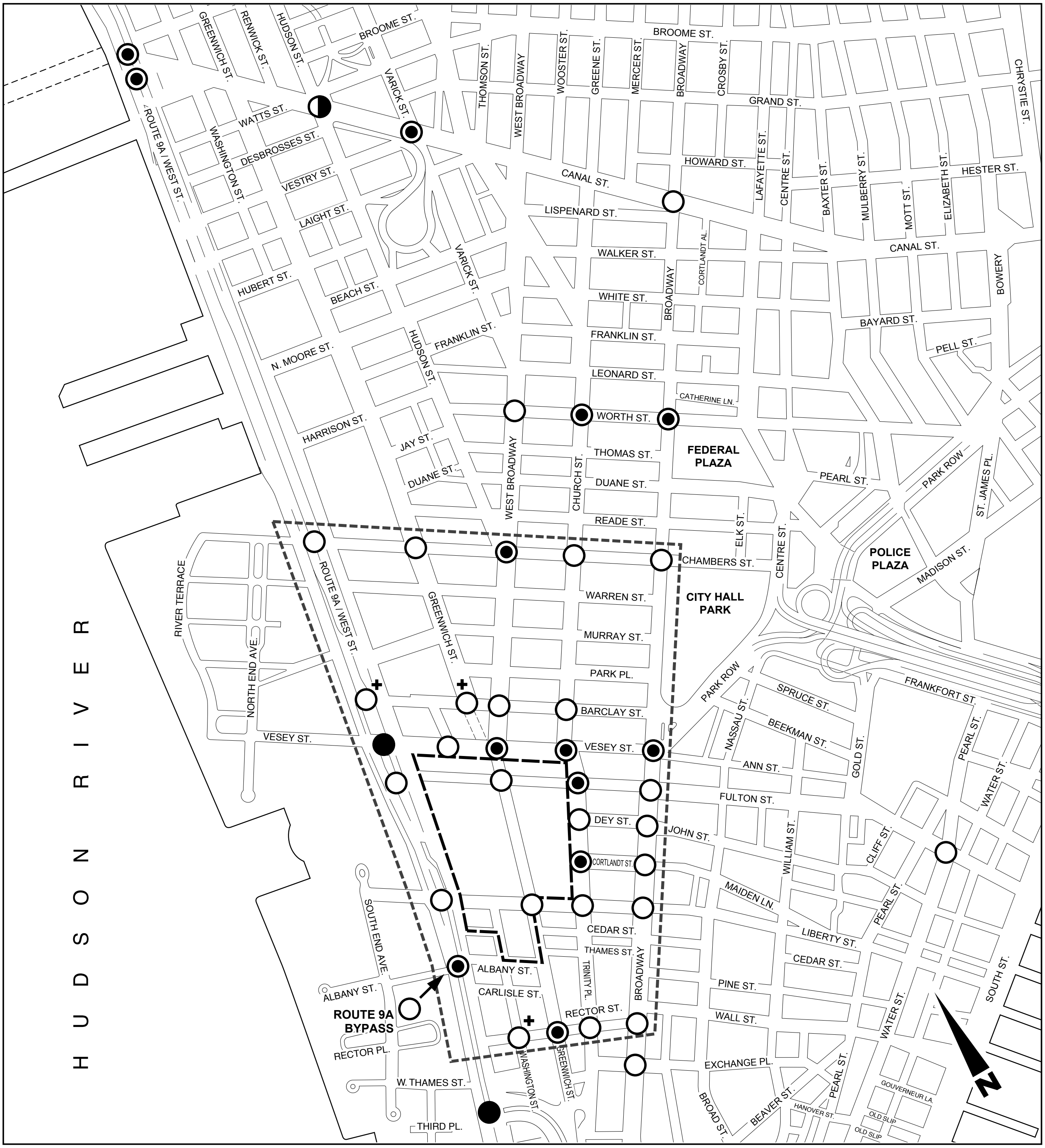
Unsignalized Intersection

Traffic Mitigation Overview
2009 AM Peak Hour
With Route 9A At-Grade

World Trade Center Memorial and Redevelopment Plan

Figure 22-1

3.25.04



0 1000 FEET
SCALE

Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

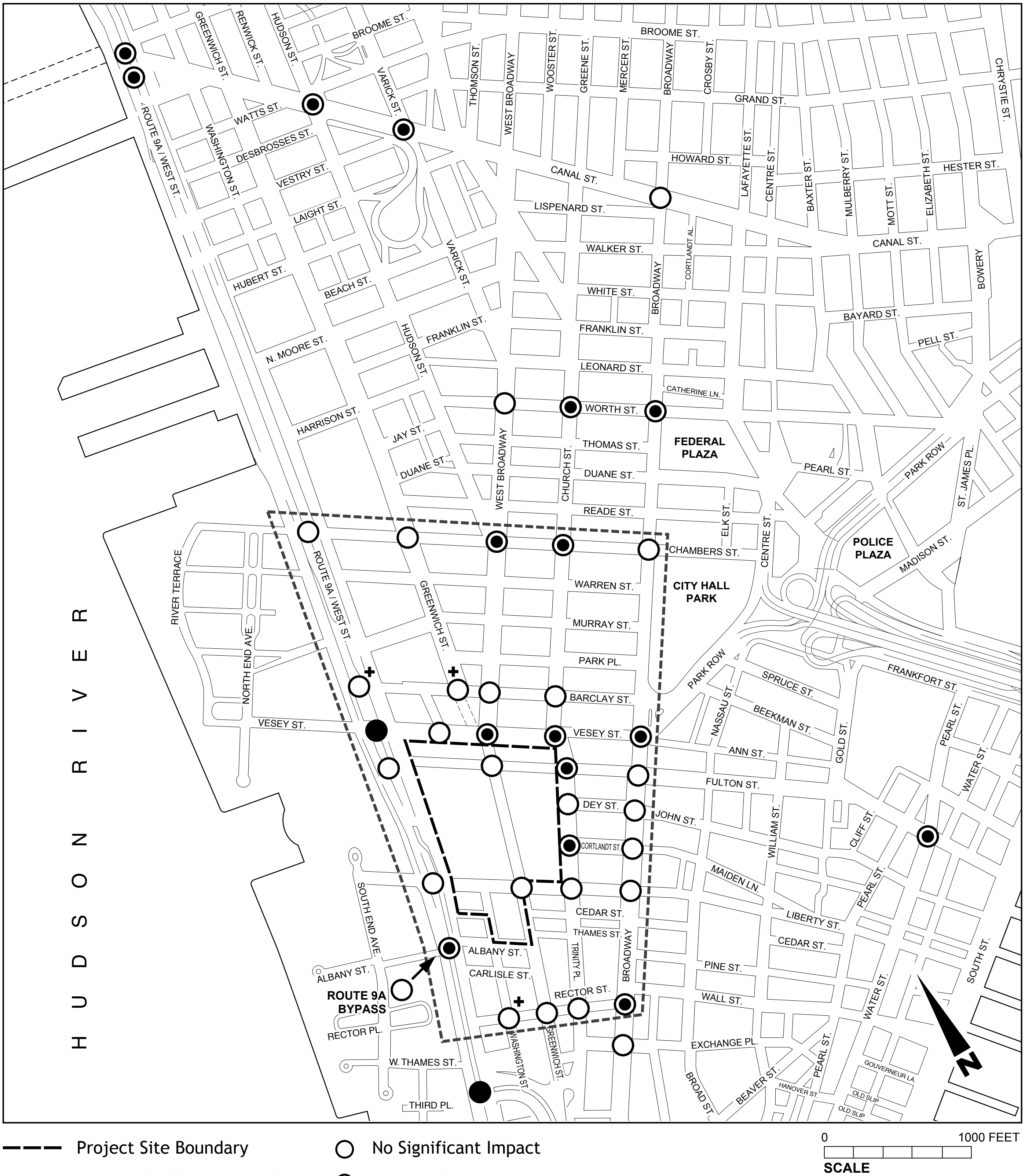
Unmitigated Impact

Unsignalized Intersection

Traffic Mitigation Overview
2009 Midday Peak Hour
With Route 9A At-Grade

Figure 22-2

3.25.04



Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

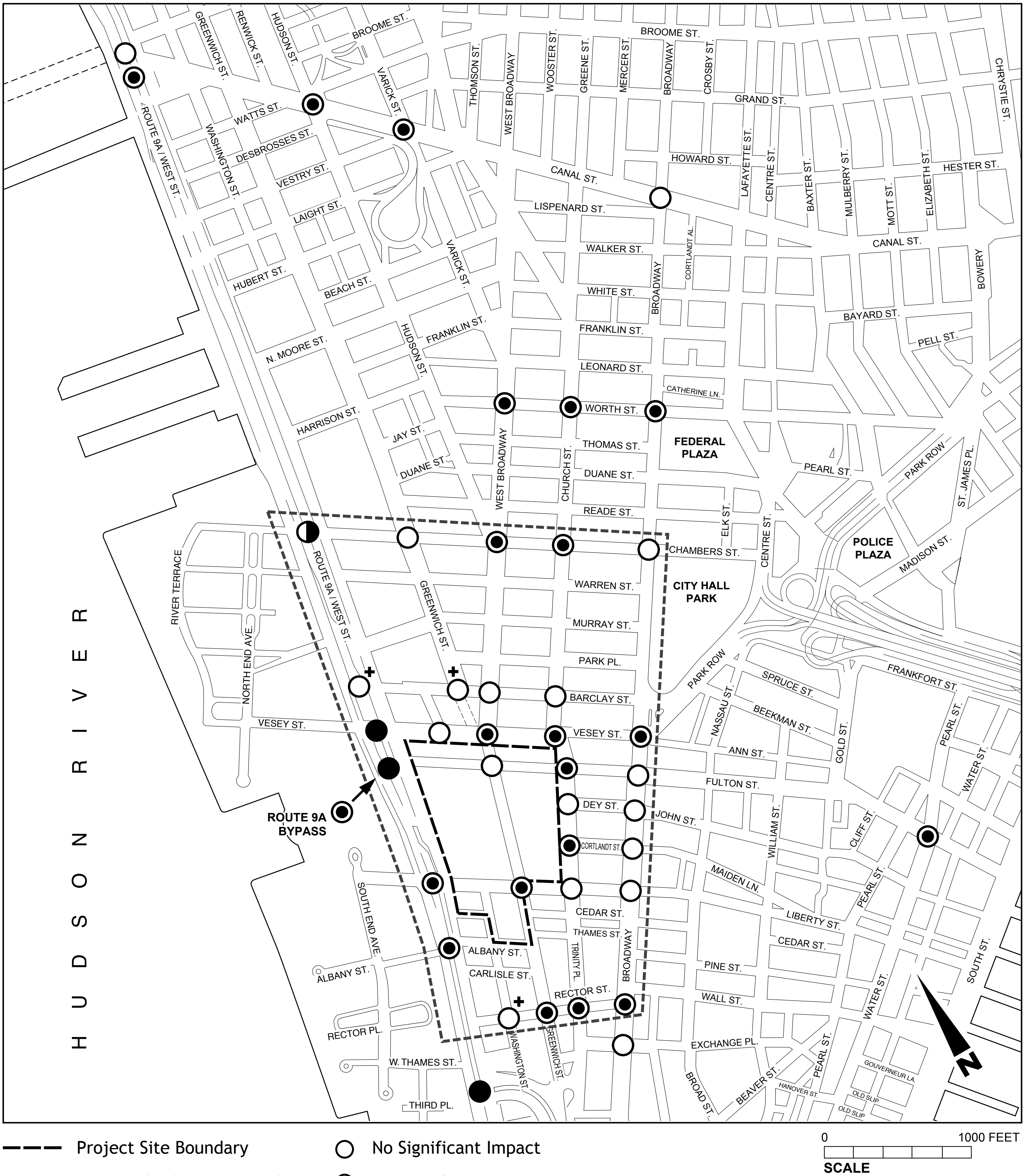
Unmitigated Impact

Unsignalized Intersection

Traffic Mitigation Overview
2009 PM Peak Hour
With Route 9A At-Grade

Figure 22-3

3.25.04



Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

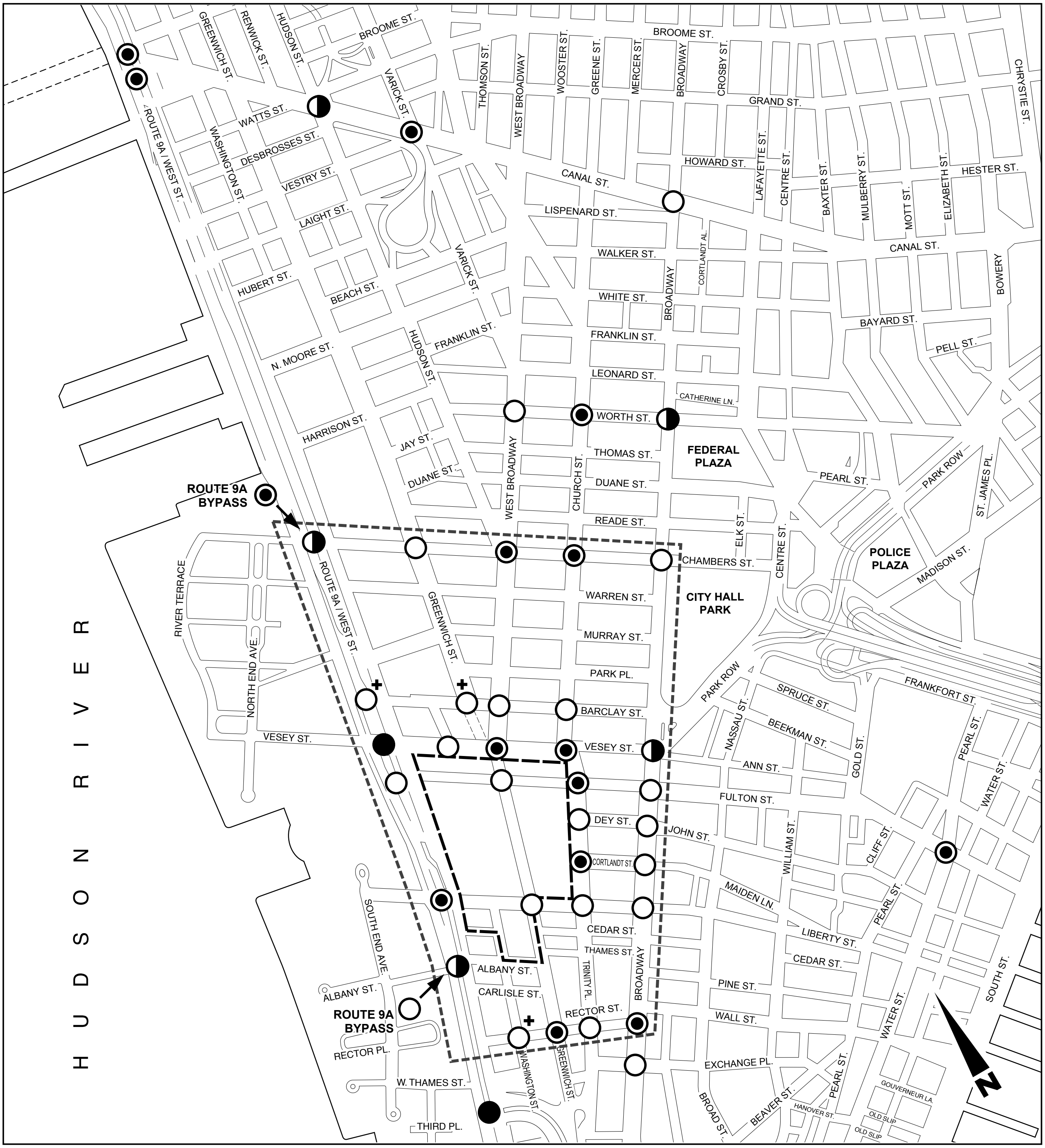
Unmitigated Impact

Unsignalized Intersection

Traffic Mitigation Overview
2015 AM Peak Hour
With Route 9A At-Grade

World Trade Center Memorial
and Redevelopment Plan

Figure 22-4



Project Site Boundary
Primary Study Area Boundary
No Significant Impact
Mitigated Impact
Partially Mitigated Impact
Unmitigated Impact
+ Unsignalized Intersection

Traffic Mitigation Overview
2015 Midday Peak Hour
With 9A At-Grade

Figure 22-5

lower than they would have been had the events of September 11 not occurred. So some of the traffic mitigation measures are, in fact, measures that would be implemented by the responsible agencies (such as the New York City Department of Transportation [NYCDOT] for signal phasing and timing changes, lane re-striping, and other measures) in the absence of the Proposed Action.

The detailed traffic mitigation analyses and measures that are described in this section of the GEIS demonstrate the ability of a specific set of traffic measures to mitigate impacts. It is also possible that alternative measures may work as well and be the preferred course of action by city agencies responsible for traffic operations and enforcement. There are also several street direction changes being considered by NYCDOT to improve overall traffic operations in Lower Manhattan that could either serve to mitigate some of the impacts discussed above to eliminate the potential for impacts. For example, consideration is being given to making Vesey Street one-way eastbound from Route 9A to Church Street (from its previous two-way operation), to "match" Vesey Street's one-way eastbound configuration east of Church Street. This would be a major improvement along the length of Vesey Street, although westbound diversions would also need to be assessed.

There are also areawide traffic management strategies that could be implemented to minimize traffic impacts projected for several key locations along Route 9A. For example, the anticipated saturation of Route 9A with traffic destined to the Project Site and its immediate environs could be better distributed to other streets with available capacity by monitoring traffic conditions on Route 9A and directing traffic to alternate routes should congestion be observed. This could be a particularly effective means of mitigating traffic impacts along the Route 9A corridor that might otherwise be very difficult to mitigate by other measures. This type of "intelligent" traffic system is being implemented citywide on other major roadways as a means of advising motorists of traffic congestion ahead and thus allowing them to decide whether to shift to other roads.

A synopsis of traffic mitigation measures per intersection for each of the two traffic analysis years is presented below for conditions with the Route 9A at-grade arterial design; significant differences for conditions with the Route 9A short bypass tunnel design follow. Further information on areawide traffic management measures also follows.

22.3.2 2009 TRAFFIC MITIGATION

This section describes the specific traffic capacity improvements that would be needed to mitigate significant traffic impacts generated under the Proposed Action for interim build-out conditions in 2009.

ROUTE 9A CORRIDOR

Six of the seven existing signalized intersections analyzed along the Route 9A corridor would be significantly impacted during the AM peak hour, and four would be significantly impacted during the midday and PM peak hours, with the at-grade arterial design. Where differences are significant for the short bypass tunnel design, they are highlighted below. (Note: the Route 9A and Canal Street "intersection" comprises two adjacent signalized intersections that, in effect, operate as one. If either of the two adjacent intersections are significantly impacted, this summary essentially describes that "overall" intersection as being impacted). The newly created signalized intersection of Route 9A and Fulton Street would require new signal timings. The unsignalized intersection of Route 9A and Barclay Street would not be significantly impacted.

Route 9A and Canal Street

A series of measures would be needed to mitigate impacts, including: (a) a revised signal phasing and timing plan for better coordination and operation of the two adjacent intersections; (b) re-striping westbound Canal Street to provide two 11-foot-wide left turn lanes and one 11-foot right turn lane; (c) shifting the pedestrian crosswalk across the southernmost of the two intersections further north to a crossing at the northernmost intersection.

Route 9A and Chambers Street

There would not be any significant impacts in the midday and PM peak hours. In the AM peak hour, traffic impacts could be partially, but not fully, mitigated via signal timing modifications. Additional measures discussed later in this section address this issue.

Route 9A and Vesey Street

Traffic impacts at this intersection cannot be mitigated using signal timing changes, parking or enforcement, or channelization improvements. Additional measures discussed later in this section address this issue.

Route 9A and Fulton Street

New signal timings would be needed to improve AM peak hour conditions for this intersection created by the extension of Fulton Street westward through the WTC Site to Route 9A.

Route 9A and Albany Street

A series of measures would be needed to mitigate impacts: (a) prohibiting parking on the south side of eastbound Albany Street approaching Route 9A to add a travel lane; (b) providing a 13-foot-wide exclusive right turn lane along westbound Albany Street; and (c) making signal timing modifications. These capacity improvement measures would be needed during the AM, midday, and PM peak traffic hours under the at-grade arterial design for Route 9A. With the short bypass tunnel design, there would be no significant impacts at this location.

Route 9A and the Entrance to the Brooklyn Battery Tunnel

Traffic impacts at this intersection cannot be mitigated using signal timing changes, parking or enforcement, or channelization improvements. Additional measures discussed later in this section address this issue.

WASHINGTON STREET

Significant traffic impacts are not expected at the signalized intersection of Washington Street and Vesey Street or at the unsignalized intersection of Washington Street and Rector Street.

GREENWICH STREET CORRIDOR

One of the four signalized intersections analyzed along Greenwich Street would be significantly impacted in the midday peak hour. The unsignalized intersection of Greenwich Street and Barclay Street would not be significantly impacted.

Greenwich Street and Rector Street

The northbound and southbound Greenwich Street approaches to the intersection would need to be re-striped to provide a 12-foot exclusive northbound right turn lane adjacent to the curb parking lane, and the southbound approach to the intersection would need to be re-striped to provide a 12-foot-wide exclusive left turn lane and a through lane. Signal timing modifications would also be needed. Even though this would be needed only to mitigate midday peak hour impacts, the measures would in fact be in place all day and would accommodate traffic in the AM and PM peak hours, as well.

CANAL STREET

At least one of the two intersections analyzed would be impacted in all three traffic peak hours. (Two other Canal Street intersections—at Route 9A and at Broadway—are addressed within the "Route 9A Corridor" mitigation above and the "Broadway Corridor" mitigation below, respectively).

Canal Street and Hudson Street

Three actions would be needed to mitigate AM, midday, and PM peak hour impacts—re-striping the eastbound Canal Street left turn lane from its current 11-foot width to 12 feet by reducing the median by 1 foot, prohibiting truck loading/unloading along the west side of northbound Hudson Street approaching Canal Street during peak hours to gain an additional northbound travel lane, and signal timing modifications. AM and PM peak hour impacts could be fully mitigated via these measures, while midday impacts could only be partially mitigated.

WEST BROADWAY CORRIDOR

Three of the four intersections analyzed along West Broadway would be significantly impacted in the AM peak hour, while two of the four would be significantly impacted in the midday and PM peak hours.

West Broadway and Worth Street

AM peak hour impacts could be mitigated by strictly enforcing No Standing Anytime parking regulations along the west side of West Broadway to gain an additional southbound travel lane and by modifying current signal timings. There would be no significant impacts in the midday and PM peak hours.

West Broadway and Chambers Street

AM, midday, and PM peak hour impacts could be mitigated via signal timing modifications.

West Broadway/Greenwich and Vesey Street

AM, midday, and PM peak hour impacts could be mitigated via signal timing modifications and by prohibiting left turns from southbound Greenwich Street onto Vesey Street (the Greenwich Street approach, with right turns only allowed, would become stop sign-controlled).

CHURCH STREET CORRIDOR

Four of the nine intersections would be significantly impacted in the AM and midday peak hours; five of the nine intersections would be impacted in the PM peak hour.

Church Street and Worth Street

To mitigate AM and midday peak hour impacts, it would be necessary to prohibit parking along the west side of northbound Church Street to provide an additional travel lane and to modify existing signal timings. In the PM peak hour, only the parking prohibitions would be needed.

Church Street and Chambers Street

AM and PM peak hour impacts could be mitigated by eliminating the truck loading/unloading zone along the west side of Church Street to gain an additional northbound travel lane. There would be no significant impacts in the midday peak hour.

For the segment of Church Street extending from Vesey Street to Liberty Street, alongside the eastern edge of the WTC Site, a general reconfiguration of Church Street to promote pedestrian crossings is suggested along with additional mitigation measures. This reconfiguration would consist of the following: (a) modifying the signal timing plans at each intersection to utilize a 120-second signal cycle with a pedestrian-only phase; (b) eliminating the priority bus lane along the east curb in order to add a general traffic lane that is needed to accommodate the additional traffic volume anticipated for Church Street; (c) building out the sidewalk at each intersection to provide additional pedestrian reservoir space before crossings as well as to shorten the crossing distance for pedestrians across Church Street (the length of Church Street on its western side, between the built-out sidewalk areas, could be used for either bus layovers, loading, or taxi and auto drop-offs). Additional measures for specific intersections are cited below:

Church Street and Vesey Street

Re-stripe the eastbound Vesey Street approach to the intersection to provide one eastbound through lane and one shared through-left turn lane as was in place in the pre-September 11 condition, and relocate the bus layover zone along the west side of Church Street between Vesey and Fulton Streets to the far side block (between Vesey and Barclay Streets) to gain a northbound travel lane along Church Street approaching Vesey Street.

Church Street and Fulton Street

Re-stripe the westbound Fulton Street approach to the intersection from its current one shared through-right turn lane to one 12-foot-wide through lane and one 12-foot-wide shared through-right turn lane. During the midday period, it would also be necessary to prohibit parking along both sides of Fulton Street approaching Church Street.

Church Street and Cortlandt Street

Prohibit parking along the south side of Cortlandt Street approaching Church Street, and re-stripe the westbound Cortlandt Street approach to the intersection from one wide 16-foot turning lane to two 12-foot-wide right turn lanes.

BROADWAY CORRIDOR

Three of the 10 intersections analyzed along Broadway would be significantly impacted in the AM and PM peak hours, while two of the intersections analyzed would be significantly impacted in the midday peak hour.

Broadway and Worth Street

This intersection would be significantly impacted during all three traffic analysis hours and would require a combination of signal timing modifications in the AM and midday peak hours, and strict enforcement of existing No Parking regulations and prohibition of truck loading/unloading along the east side of southbound Broadway to gain a travel lane during all three peak hour conditions.

Broadway and Vesey Street/Ann Street

During the AM, midday, and PM peak hours, it would be necessary to implement the following mitigation measures: (a) prohibiting parking along the north side of eastbound Vesey Street approaching the intersection; (b) reconfiguring the lane layout on southbound Broadway approaching the intersection to provide two exclusive through travel lanes and two excusive left turn lanes (with the easternmost left-turn lane designated for Park Row only); (c) signal timing modifications.

Broadway and Rector Street

AM and PM peak hour impacts could be mitigated via signal timing modifications; midday impacts are not anticipated.

WATER STREET

One intersection was analyzed along Water Street—at Fulton Street—and it can be expected to be significantly impacted in the AM and PM peak hours. Signal timing modifications would be able to mitigate the projected impacts.

22.3.3 2015 TRAFFIC MITIGATION

This section describes the specific traffic capacity improvements that would be needed to mitigate significant traffic impacts generated under the Proposed Action in 2015.

In Chapter 13A, “Traffic and Parking,” it was noted that an alternative set of less conservative trip generation and modal split assumptions was analyzed in section 13A.7 as an alternative trip generation scenario to that detailed earlier throughout that chapter. For the alternative set of assumptions, detailed level of service analyses were conducted at key representative intersections that would be significantly impacted by the Proposed Action, many of which were considered very difficult to mitigate either partially or fully. In section 13A.7, it was noted that the less conservative set of assumptions would not make an appreciable change in the number of significantly impacted locations, but could potentially make them more mitigatable. The findings of the mitigation analyses at these 15 locations under the alternative set of assumptions is presented in this part of the section of the traffic mitigation findings, where the analysis identified the potential to better mitigate significant impacts.

ROUTE 9A CORRIDOR

All seven existing signalized intersections analyzed along the Route 9A corridor would be significantly impacted during the AM peak hour, and six of the seven would be significantly impacted during the midday and PM peak hours, with the at-grade arterial design. Where differences are significant for the short bypass tunnel design, they are highlighted below. As noted above for year 2009 mitigation analyses, the Route 9A and Canal Street "intersection" is comprised of two adjacent signalized intersections that, in effect, operate as one; if either of the two intersections are significantly impacted, this summary describes that "overall" intersection as being impacted. The unsignalized intersection of Route 9A and Barclay Street would not be significantly impacted.

Route 9A and Canal Street

The same measures identified above for year 2009 conditions would be needed for year 2015 conditions, with one addition—in the PM peak hour, it would also be necessary to strictly enforce existing No Standing regulations along the north side of Canal Street approaching Route 9A.

Route 9A and Chambers Street

Under the at-grade arterial design, AM, midday, and PM peak hour impacts could be partially, but not fully, mitigated via signal timing modifications. Additional measures discussed later in this section address this issue. With the short bypass tunnel design, midday and PM peak hour impacts would be fully mitigated, rather than just partially mitigated.

Route 9A and Vesey Street

Traffic impacts at this intersection cannot be mitigated using signal timing changes, parking or enforcement, or channelization improvements. Additional measures discussed later in this section address this issue.

The analysis of this intersection under the alternative set of trip generation/modal split assumptions yielded the same finding of an inability to mitigate impacts via standard traffic capacity improvements, although intersection delays would be substantially lower.

Route 9A and Fulton Street

Under the at-grade arterial design, in the AM peak hour, optimal signal timings would allow for overall LOS D conditions, with delays just above the threshold of mid-LOS D; this could be considered an unmitigated impact. With the short bypass tunnel design, overall LOS C conditions could be provided.

The analysis of this intersection under the alternative assumptions yielded the same finding of an unmitigated impact in the AM peak hour, although the overall intersection would operate with delays just below the mid-LOS D threshold indicating overall acceptable conditions.

Route 9A and Liberty Street

Under the at-grade arterial design, AM, midday, and PM peak hour impacts could be mitigated via signal timing modifications. Under the short bypass tunnel design, there would be no significant impacts in the PM peak hour.

Route 9A and Albany Street

For the at-grade arterial design, AM peak hour impacts could be mitigated via the same measures described above for year 2009 conditions. Application of these measures, however, would only partially mitigate midday and PM peak hour impacts. Additional measures discussed later in this section would be needed to fully address the issue. With the short bypass tunnel design, there would be no significant impacts in the midday and PM peak hours.

Under the alternative, less conservative set of trip generation/modal split assumptions, all impacts could be fully mitigated even with the at-grade arterial design for Route 9A.

Route 9A and the Entrance to the Brooklyn Battery Tunnel

Traffic impacts at this intersection cannot be mitigated using signal timing changes, parking or enforcement, or channelization improvements. Additional measures discussed later in this section address this issue.

The analysis of this intersection under the alterative set of trip generation/modal split assumptions yielded the same finding of an inability to mitigate impacts via standard traffic capacity improvements.

WASHINGTON STREET

Significant traffic impacts are not expected at the signalized intersection of Washington Street and Vesey Street or at the unsignalized intersection of Washington Street and Rector Street.

GREENWICH STREET CORRIDOR

Two of the four signalized intersections analyzed along Greenwich Street would be significantly impacted in the AM and PM peak hours, and one of the four intersections would be impacted in the midday peak hour. The unsignalized intersection of Greenwich Street and Barclay Street would not be significantly impacted.

Greenwich Street and Liberty Street

AM and PM peak hour impacts could be mitigated via signal timing modifications. There would be no significant impacts at midday.

Greenwich Street and Rector Street

As described above for year 2009 conditions, the northbound and southbound Greenwich Street approaches to the intersection would need to be re-striped to provide a 12-foot exclusive northbound right turn lane adjacent to the curb parking lane, and the southbound approach to the intersection would need to be re-striped to provide a 12-foot-wide exclusive left-turn lane and a through lane, for all three traffic peak hours. Signal timing modifications would also be needed in the midday peak hour, and it would also be necessary to prohibit parking on the south side of eastbound Rector Street at its approach to Greenwich Street at midday.

CANAL STREET

The two intersections analyzed would be impacted in all three traffic peak hours. (Two other Canal Street intersections—at Route 9A and at Broadway—are addressed within the "Route 9A Corridor" mitigation above and the "Broadway Corridor" mitigation below, respectively).

Canal Street and Hudson Street

The same findings described above for year 2009 conditions would apply to year 2015 conditions (except that the eastbound Canal Street left turn lane would need to be widened to 14 feet by reducing the width of the median). As described for year 2009 conditions, AM and PM peak hour impacts could be fully mitigated by these measures, while midday impacts could only be partially mitigated.

This intersection was also analyzed under the alternative assumptions. The analysis found that significant impacts could be mitigated in all three traffic analysis periods.

Canal Street and Varick Street

Signal timing modifications would be sufficient to mitigate impacts in the AM, midday, and PM peak hours.

WEST BROADWAY CORRIDOR

Three of the four intersections analyzed along West Broadway would be significantly impacted in the AM and PM peak hours, while two of the four would be significantly impacted in the midday peak hour.

West Broadway and Worth Street

AM and PM peak hour impacts could be mitigated by strictly enforcing No Standing Anytime parking regulations along the west side of West Broadway to gain an additional southbound travel lane and by modifying current signal timings. There would be no significant impacts in the midday peak hour.

West Broadway and Chambers Street

AM, midday, and PM peak hour impacts could be mitigated via signal timing modifications, similar to year 2009 conditions.

West Broadway/Greenwich and Vesey Street

The same findings described above for year 2009 conditions would apply to year 2015 conditions.

CHURCH STREET CORRIDOR

Six of the nine intersections would be significantly impacted in the AM and PM peak hours; five of the nine intersections would be impacted in the midday peak hour.

Church Street and Worth Street

In order to mitigate AM, midday, and PM peak hour impacts, it would be necessary to prohibit parking along both sides of northbound Church Street approaching the intersection to provide an additional travel lane and one new exclusive right turn lane; signal timing modifications would also be needed in the AM peak hour. It would also be necessary to prohibit parking along the north side of westbound Worth Street and to shift the centerline of the street southward by 7 feet in order to provide one 12-foot-wide through lane and one 12-foot-wide exclusive right-turn lane, which would apply throughout the day.

Church Street and Chambers Street

A series of mitigation measures would be needed during all three peak periods—eliminating the truck loading/unloading zone along the west side of Church Street to gain an additional northbound travel lane, strictly enforcing existing No Standing Anytime regulations along the north and south sides of Chambers Street, and signal timing modifications (midday and PM peak hours, only, for signal timing changes).

For the segment of Church Street extending from Vesey Street to Liberty Street, alongside the eastern edge of the World Trade Center site, the same general reconfiguration of Church Street to promote pedestrian crossings described above for year 2009 conditions is suggested, along with additional measures for specific intersections as described below:

Church Street and Vesey Street

Same measures as described for year 2009 conditions.

Church Street and Fulton Street

Same measures as described for year 2009 conditions. AM and midday peak hour impacts could be fully mitigated, while PM impacts would be partially mitigated.

Under the alternative set of assumptions, significant impacts can be mitigated in all three traffic analysis hours.

Church Street and Cortlandt Street

Same measures as described for year 2009 conditions.

Church Street/Trinity Place and Rector Street

Signal timing modifications would be needed to mitigate AM and PM peak hour impacts.

BROADWAY CORRIDOR

Three of the 10 intersections analyzed along Broadway would be significantly impacted in the AM, midday, and PM peak hours.

Broadway and Worth Street

This intersection would be significantly impacted during all three traffic analysis hours and would require a combination of mitigation measures: (a) relocation of the bus stop along eastbound Worth Street from its current near side location to the far side of the intersection and increasing the lane width of the eastbound Worth Street approach to the intersection from its current 14 feet to 15 feet; (b) strict enforcement of existing No Parking regulations and prohibition of truck loading/unloading along the east side of southbound Broadway to gain a travel lane; (c) strict enforcement of existing No Parking regulations along the westbound Worth Street approach to the intersection in order to provide one westbound through lane and one exclusive left turn lane; and (d) signal timing modifications in the AM and midday peak hours. AM and PM peak hour impacts could be fully mitigated, while midday impacts would be partially mitigated.

Analysis of this intersection under the alternative set of trip generation/modal split assumptions yielded the same finding of only partial mitigation in the midday peak hour.

Broadway and Vesey Street/Ann Street

The same measures described above for year 2009 conditions would be needed in year 2015, with AM and PM peak hour impacts fully mitigated and midday peak hour impacts partially mitigated.

Broadway and Rector Street

AM, midday, and PM peak hour impacts could be mitigated via signal timing modifications.

WATER STREET

One intersection was analyzed along Water Street—at Fulton Street—and it can be expected to be significantly impacted in the AM, midday, and PM peak hours. Mitigation would entail re-striping the northbound Water Street approach to the intersection to provide one through lane and one shared through-left turn lane.

OVERALL STUDY AREA

Overall, under the original set of trip generation and modal assumptions, standard traffic capacity improvements would not be sufficient to fully mitigate expected significant impacts at four locations in the AM peak hour, seven locations in the midday peak hour, and five locations in the PM peak hour. Under the alternative set of assumptions, the number of unmitigated or partially mitigated locations would be less: three locations in the AM peak hour, three locations in the midday peak hour, and two locations in the PM peak hour. These locations include Route 9A at Vesey Street and at the entrance to the Brooklyn Battery Tunnel; Route 9A and Fulton Street, which is a new intersection at which overall intersection mid-LOS D conditions can be achieved and are considered acceptable in New York City; and Broadway and Worth Street.

CONDITIONS WITHOUT EXTENSION OF FULTON AND GREENWICH STREETS

Traffic mitigation analyses were also conducted for a set of 15 representative critical locations, for conditions without Fulton and Greenwich Streets extended through the Project Site. These analyses indicated that there would be significant deteriorations at a number of locations. The primary difference without Fulton and Greenwich Streets extended through the Project Site would be:

(1) at the intersection of Church and Vesey Streets in the AM, midday, and PM peak hours, where the additional traffic passing through this intersection without Fulton and Greenwich Streets extended would create significant impacts that could not be mitigated by standard traffic engineering improvements (with Fulton and Greenwich Streets extended, these impacts could be mitigated);

(2) at the intersection of Route 9A and Liberty Street in the midday and PM peak hours, which would have significant impacts that could only be partially mitigated with a condition including the at-grade arterial design for Route 9A and Fulton and Greenwich Streets not extended through the Project Site (with Fulton and Greenwich Streets extended, these impacts could be mitigated);

(3) at the intersection of Broadway and Vesey Street, which would have significant impacts that could only be partially mitigated for the condition without Fulton and Greenwich Streets extended through the Project Site (with the two street extensions, these impacts could be mitigated).

Except as noted above, the same type, or set, of standard traffic capacity improvements cited previously as mitigation measures could also be implemented at locations significantly impacted without the two street extensions and would have comparable effects in mitigating such impacts.

22.3.4 2009 TRAFFIC MITIGATION WITH STREET DIRECTION CHANGES

One additional set of traffic analyses was conducted since publication of the DGEIS—an analysis of a series of street direction changes that are being considered for implementation (see Chapter 13A, section 13A.8, "Projected Conditions with Street Direction Changes"). These street direction changes are being considered as a means of improving traffic flow around the Project Site. They include converting Vesey Street between Route 9A and Church Street from two-way flow to one-way eastbound flow, narrowing the roadway width of Greenwich Street within the Project Site and widening its sidewalks, and making the truck entrance ramp into the underground parking garage along the north side of Liberty Street into a two-directional ramp that would also allow cars parked under the site to exit via this ramp rather than having only the single exit along Vesey Street, and retaining Albany Street as a one-way eastbound street rather than making it one-way westbound as has been analyzed in Chapter 13A.

The primary findings of the traffic level of service analyses with these street direction changes, as documented in Chapter 13, "Traffic and Parking," were that:

(1) conditions along Vesey Street would be significantly improved with its operation as a one-way eastbound street rather than continuing its historical two-way operation;

(2) conditions along the extension of Fulton Street through the Project Site, particularly at its intersections with Greenwich Street and with Route 9A, would worsen under the burden of carrying much of the westbound traffic that would divert off of the previously westbound lanes of Vesey Street, as would conditions along westbound Barclay Street at its approach to Route 9A since it would also absorb some of the westbound traffic diversions off of Vesey Street;

(3) there could be some deterioration of conditions along Chambers Street at Greenwich Street and at West Broadway; and

(4) conditions at the intersection of Route 9A and Liberty Street would also deteriorate since autos parked in the underground garage would be able to exit the Project Site via a new two-directional ramp that would lead to Liberty Street.

Even though the street direction changes identified and being considered for the Project Site by the LMDC, the Port Authority, and NYCDOT would be beneficial in alleviating the concentration of vehicular traffic on Vesey Street and particularly at the critical intersection of Vesey Street and Route 9A, the diversion of westbound traffic to other streets in the area would warrant consideration of mitigation measures that are presented in this section of the FGEIS. This section of the FGEIS presents the findings of the traffic mitigation analyses with *the above street direction changes in place. It highlights the key differences between the analyses conducted and findings established within the DGEIS for its assumed street direction and garage access/egress configurations and the analysis and findings with the newly-proposed changes; at the vast majority of traffic analysis locations, there would be little change in impacts and mitigation needs. Figures 22-7 through 22-9 illustrate the findings of the analyses at each of the intersections in the traffic study area.*

This section describes the specific traffic capacity improvements that would be needed to mitigate significant traffic impacts generated under the Proposed Action for interim buildout conditions in 2009, with the street directions changes in place as described in section 13A.8 in the Traffic and Parking chapter—making Vesey Street one-way eastbound between Route 9A and Church Street, narrowing the roadway width of Greenwich Street between Vesey and Liberty Streets (i.e., within the Project Site), and making the Proposed Action's one-way exit ramp from the underground garage into a two-directional ramp. The analyses reflect conditions with the at-grade arterial design for Route 9A, unless noted otherwise.

ROUTE 9A CORRIDOR

Five of the six signalized intersections analyzed along the Route 9A corridor would be significantly impacted during the AM, midday, and PM peak hours with the at-grade arterial design (the intersection of Route 9A and Albany Street was not analyzed for the proposed street changes since Albany Street was no longer assumed to be reversed in its directionality, as it was under the Proposed Action addressed previously). Where differences are significant for the short bypass tunnel design, they are highlighted below. (Note: the Route 9A and Canal Street "intersection" is comprised of two adjacent signalized intersections that, in effect, operate as one. If either of the two adjacent intersections are significantly impacted, this summary essentially describes that "overall" intersection as being impacted). The unsignalized intersection of Route 9A with Barclay Street would not be significantly impacted.

Route 9A and Canal Street

At Route 9A and Canal Street, the same types of improvement measures outlined previously for the Proposed Action would be needed for conditions with the street direction changes in place. AM, midday, and PM peak hour impacts could be mitigated.

Route 9A and Chambers Street

At Route 9A and Chambers Street, there would not be any significant impacts in the midday and PM peak hours, as was determined for conditions with the Proposed Action. In the AM peak hour, significant impacts at this location could not be mitigated via standard traffic capacity improvement measures. Without the street direction changes, impacts could be partially, but also not fully, mitigated.

Route 9A and Vesey Street

Significant impacts at this location could not be mitigated via standard traffic capacity improvement measures in the AM, midday, and PM peak hours (PM peak hour impacts could be partially mitigated). However, average vehicular delays would be substantially reduced as compared to conditions without the street direction changes as a result of eliminating the westbound approach to the intersection and making Vesey Street one-way eastbound east of

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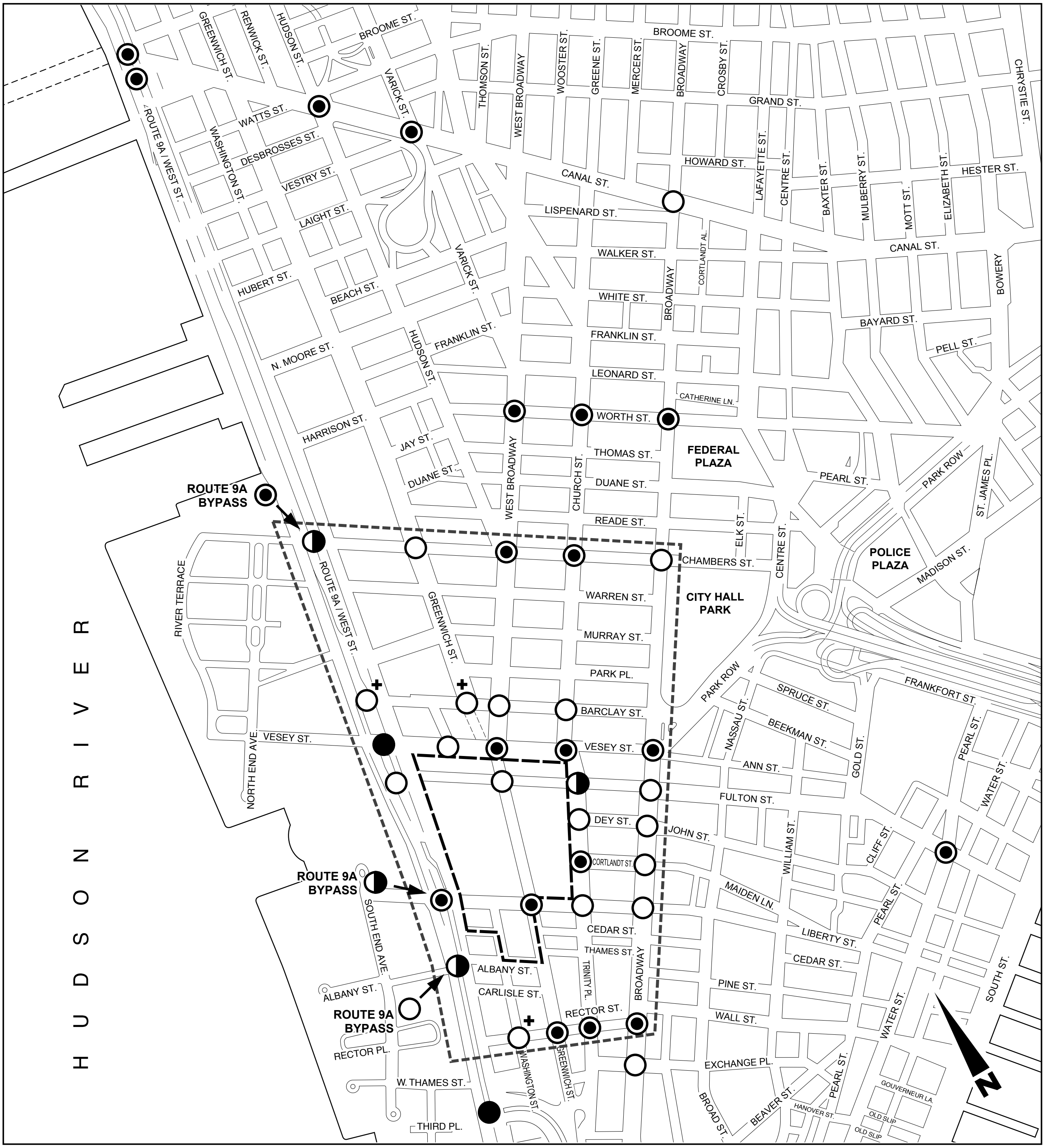


Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

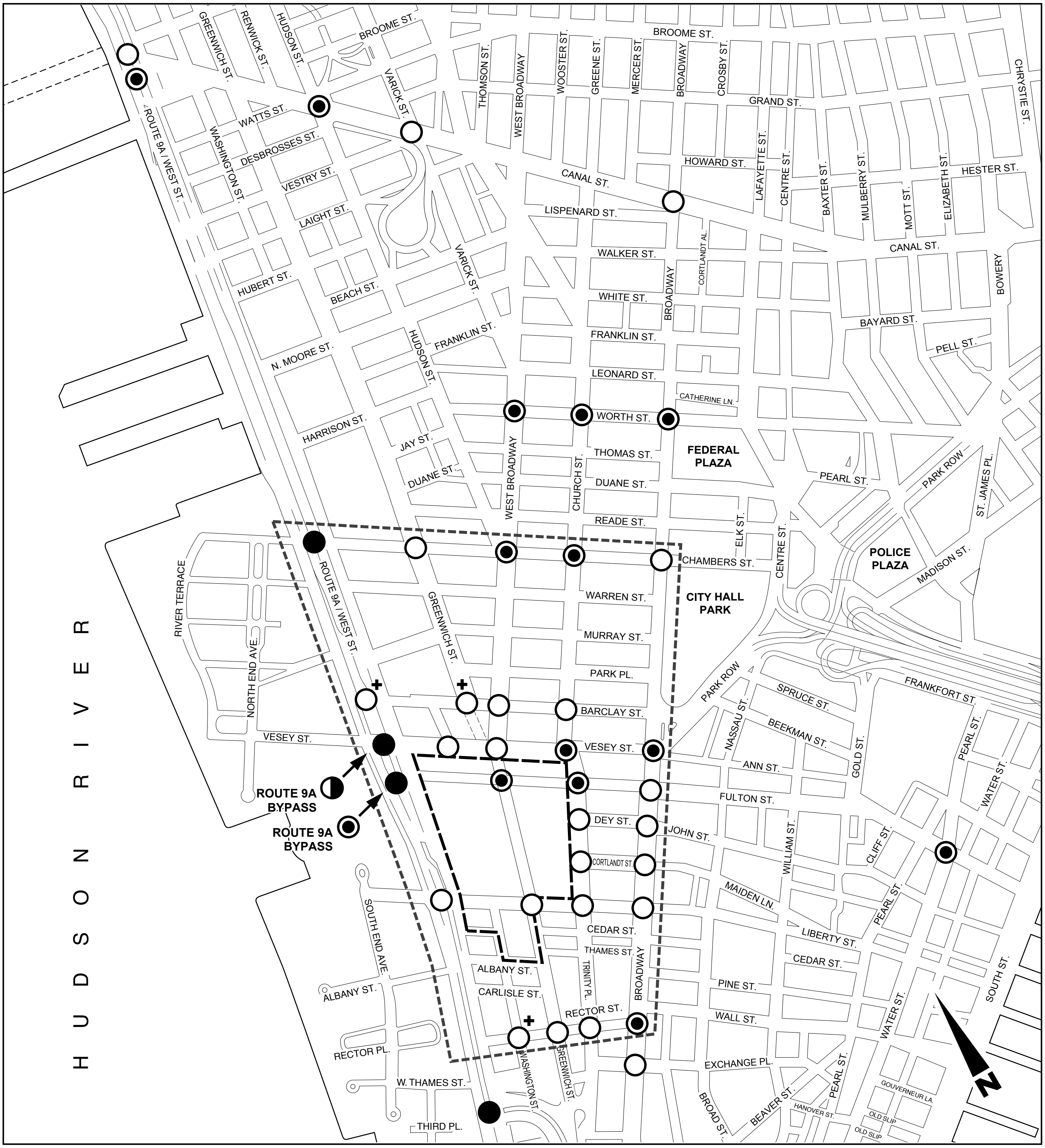
Unmitigated Impact

✚ Unsignalized Intersection

Traffic Mitigation Overview 2015 PM Peak Hour With Route 9A At-Grade

World Trade Center Memorial and Redevelopment Plan

Figure 22-6



Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

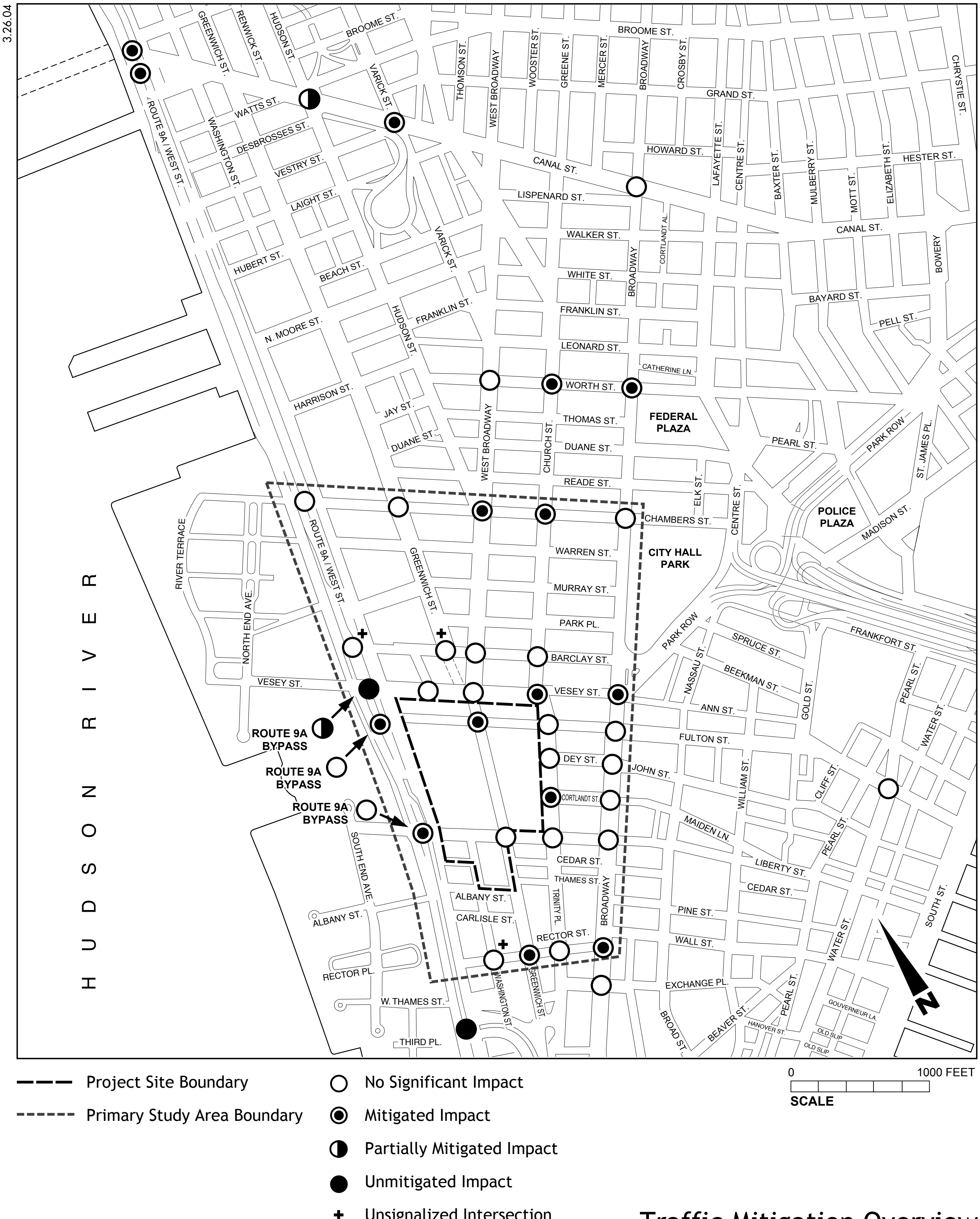
Partially Mitigated Impact

Unmitigated Impact

Unsignalized Intersection

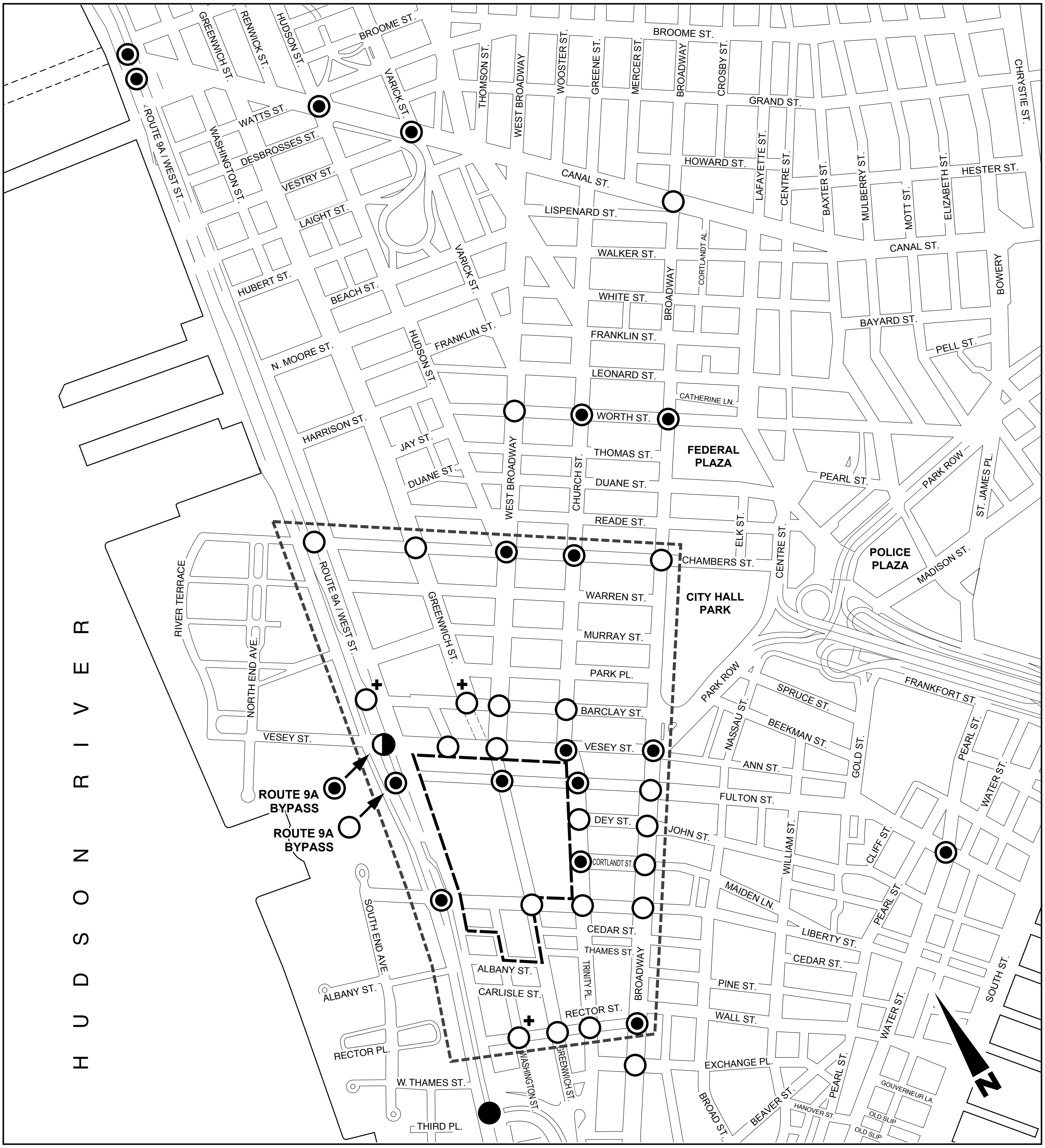
Traffic Mitigation Overview
2009 AM Peak Hour
With Route 9A At-Grade and Street Direction Changes

Figure 22-7



Traffic Mitigation Overview
2009 Midday Peak Hour
With Route 9A At-Grade and Street Direction Changes

Figure 22-8



Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

Unmitigated Impact

+ Unsignalized Intersection

Traffic Mitigation Overview
2009 PM Peak Hour
With Route 9A At-Grade and Street Direction Changes

Figure 22-9

Route 9A. For the short bypass tunnel design for Route 9A, AM and midday peak hour impacts would be partially mitigated and PM peak hour impacts would be fully mitigated.

Route 9A and Fulton Street

Significant impacts at this location could not be mitigated via standard traffic capacity improvement measures in the AM peak hour, but could be mitigated in the midday and PM peak hours via signal timing changes. Even though the AM peak hour impacts could not be mitigated, overall intersection conditions would be at overall LOS D. With the short bypass tunnel design for Route 9A, AM peak hour impacts would be fully mitigated and there would be no significant impacts in the midday and PM peak hours.

Route 9A and Liberty Street

There would be no significant impacts at this location in the AM peak hour, while midday and PM peak hour impacts could be mitigated via signal timing changes. With the short bypass tunnel design, there would be no significant impacts in the midday peak hour.

Route 9A and the Entrance to the Brooklyn Battery Tunnel

AM, midday, and PM peak hour impacts could not be mitigated, which is the same finding as was determined for the Proposed Action without the street direction changes.

WASHINGTON STREET

Significant traffic impacts are not expected at the signalized intersection of Washington Street and Vesey Street nor at the unsignalized intersection of Washington Street and Rector Street.

GREENWICH STREET CORRIDOR

Only one intersection—Greenwich Street and Fulton Street, in the heart of the Project Site—would be significantly impacted and impacts at this location in the AM, midday, and PM peak hours could be mitigated by including a pedestrian-only phase within the signal phasing plan.

CANAL STREET

At least one of the two intersections analyzed would be impacted in all three traffic peak hours. (Two other Canal Street intersections—at Route 9A and at Broadway—are addressed within the "Route 9A Corridor" mitigation above and the "Broadway Corridor" mitigation below, respectively.)

Canal Street and Hudson Street

Traffic mitigation findings are the same as those for the Proposed Action without the street direction changes—significant impacts can be mitigated in the AM and PM peak hours, and only partially mitigated in the midday peak hour—using standard traffic engineering improvements.

Canal Street and Varick Street

Traffic mitigation findings are the same as those for the Proposed Action without the street direction changes—no significant impacts in the AM peak hour, with impacts mitigatable via signal timing changes in the midday and PM peak hours.

WEST BROADWAY CORRIDOR

Two of the four intersections analyzed along West Broadway would be significantly impacted in the AM peak hour, and just one of the four would be significantly impacted in the midday and PM peak hours. The same types of traffic engineering measures cited as mitigation for Proposed Action conditions without the street conditions would be used for conditions with the street direction changes to successfully mitigate those impacts.

CHURCH STREET CORRIDOR

Four of the nine intersections analyzed along Church Street would be significantly impacted in the AM and midday peak hours, while five intersections would be significantly impacted in the PM peak hour. In general, the same types of traffic engineering measures would mitigate significant impacts for projected conditions with the street direction changes as were concluded for conditions without the street direction changes.

BROADWAY CORRIDOR

Three of the ten intersections analyzed along Broadway would be significantly impacted during all three traffic analysis hours, and could be mitigated via the same types of measures described for conditions under the Proposed Action without the street direction changes.

WATER STREET

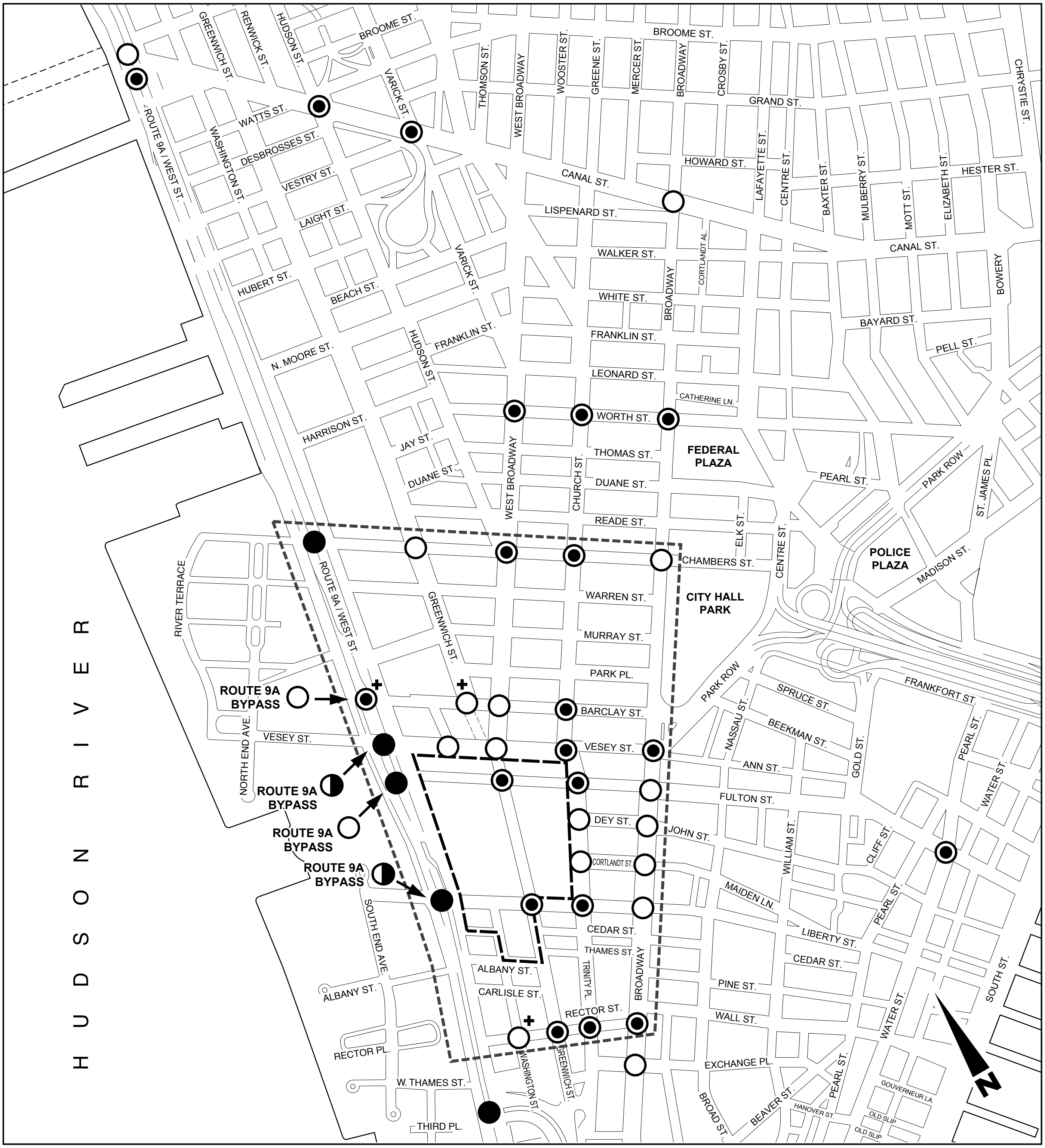
As was described for the Proposed Action without street direction changes, AM and PM peak hour impacts could be mitigated via signal timing changes, and there would be no midday peak hour impacts.

22.3.5 2015 TRAFFIC MITIGATION WITH STREET DIRECTION CHANGES

This section describes the specific traffic capacity improvements that would be needed to mitigate significant traffic impacts generated under the Proposed Action for full buildout conditions in 2015, with the street directions changes described previously in place. Figures 22-10 through 22-12 illustrate the mitigation findings for each of the intersections in the traffic study area. This section also notes where conclusions would be different had the alternative set of less conservative trip generation and modal split assumptions been used. The analyses again reflect conditions with the at-grade arterial design for Route 9A, unless noted otherwise.

ROUTE 9A CORRIDOR

All six signalized intersections analyzed along the Route 9A corridor would be significantly impacted during each of the traffic analysis hours with the at-grade arterial design for Route 9A. The unsignalized intersection of Route 9A with Barclay Street would also be significantly impacted during all three traffic analysis hours with the at-grade design plan for Route 9A. With the short bypass tunnel design for Route 9A, the intersections of Route 9A with Fulton Street and with Barclay Street would not be significantly impacted. As noted above for the year 2009 mitigation analyses, the Route 9A and Canal Street "intersection" is comprised of two adjacent intersections that essentially operate as one; if either of the two intersections are significantly impacted, this summary describes that "overall" intersection as being impacted.



—— Project Site Boundary

- - - Primary Study Area Boundary

○ No Significant Impact

◉ Mitigated Impact

◐ Partially Mitigated Impact

● Unmitigated Impact

✚ Unsignalized Intersection

Traffic Mitigation Overview
2015 AM Peak Hour
With Route 9A At-Grade and Street Direction Changes

Figure 22-10

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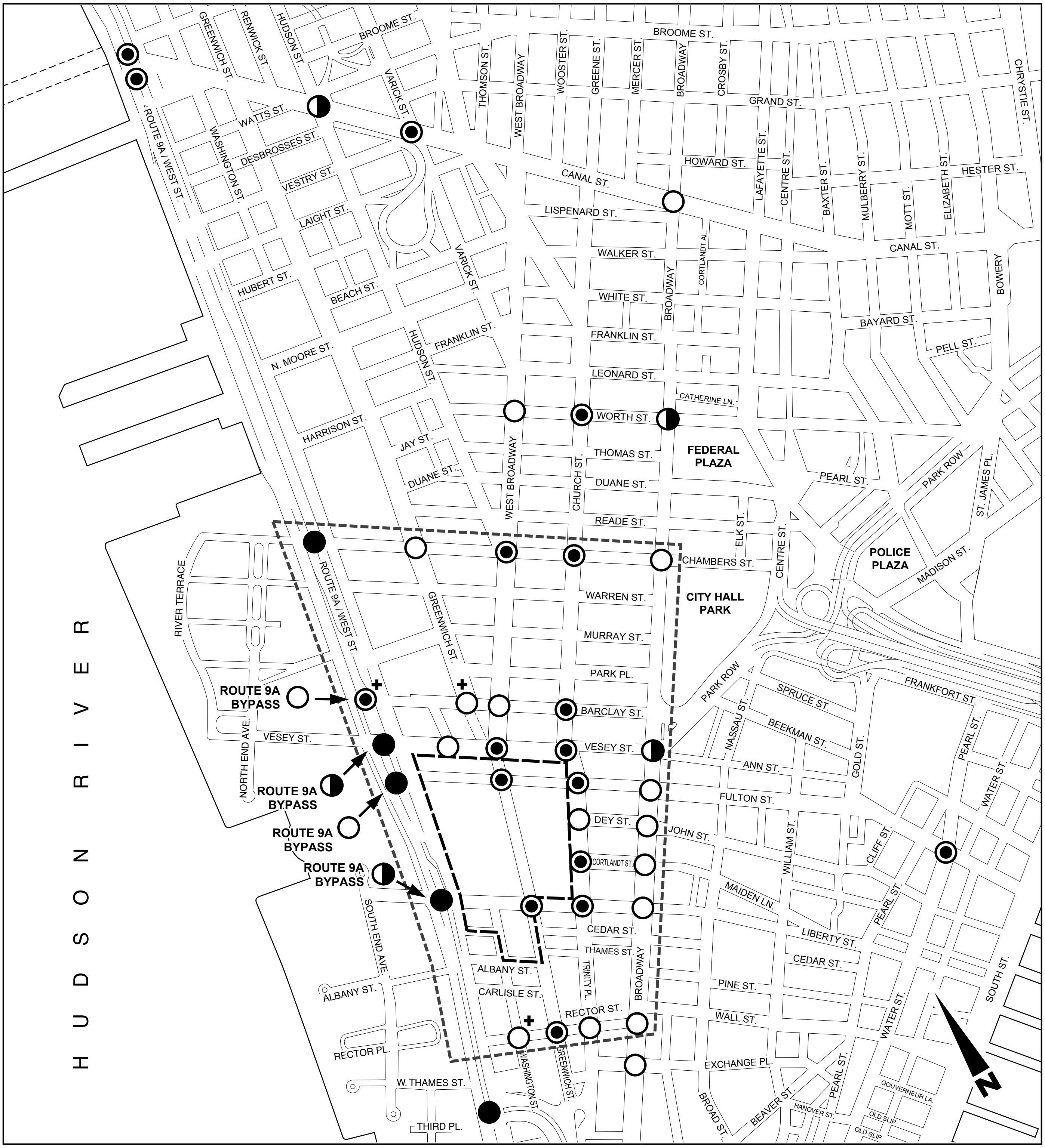


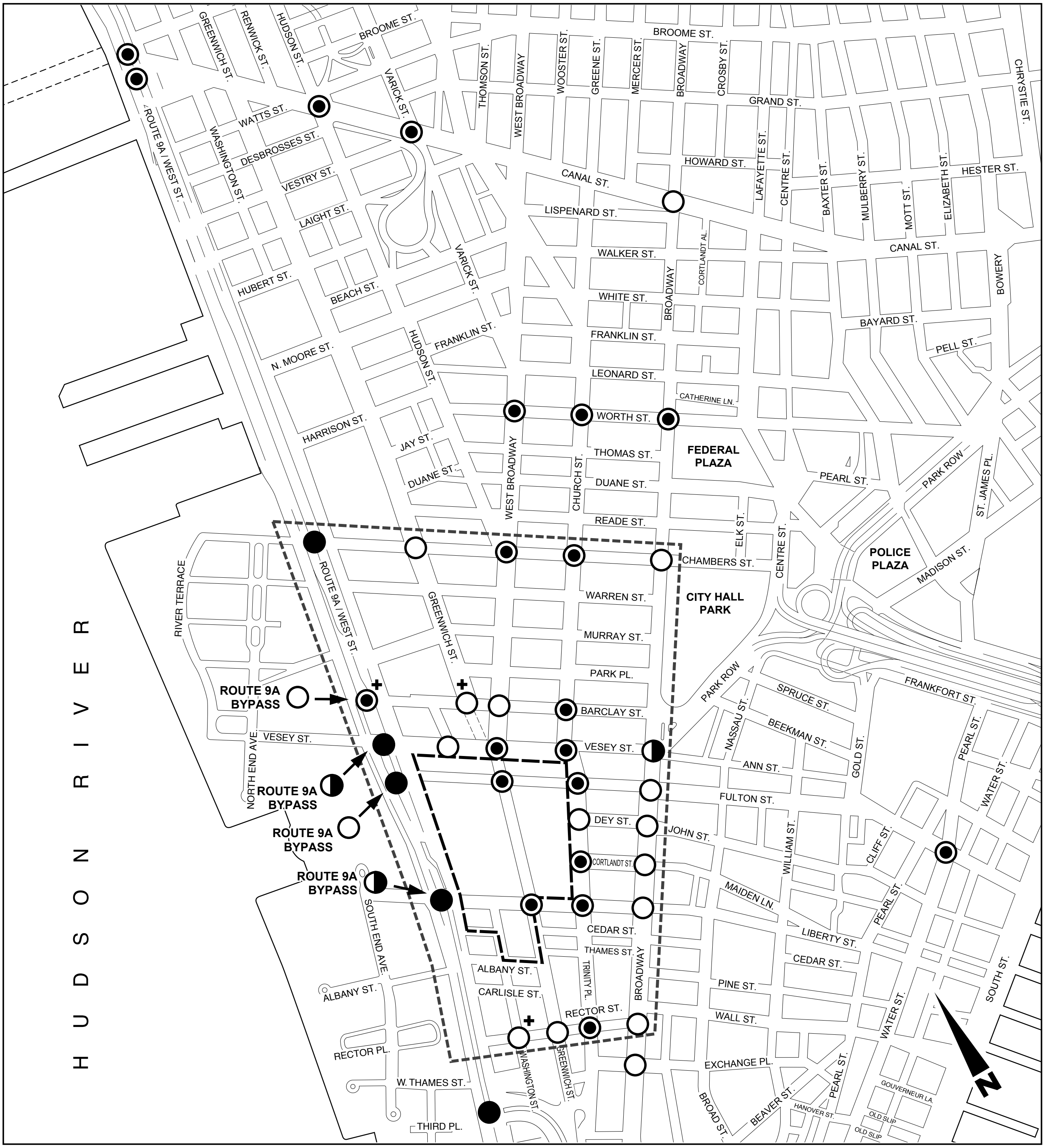
0 1000 FEET
SCALE

Project Site Boundary
Primary Study Area Boundary
No Significant Impact
Mitigated Impact
Partially Mitigated Impact
Unmitigated Impact
Unsignalized Intersection

Traffic Mitigation Overview 2015 Midday Peak Hour With 9A At-Grade and Street Direction Changes

World Trade Center Memorial and Redevelopment Plan

Figure 22-11



Project Site Boundary

Primary Study Area Boundary

No Significant Impact

Mitigated Impact

Partially Mitigated Impact

Unmitigated Impact

Unsignalized Intersection

World Trade Center Memorial
and Redevelopment Plan

Traffic Mitigation Overview
2015 PM Peak Hour
With Route 9A At-Grade and Street Direction Changes
Figure 22-12

Route 9A and Canal Street

AM, midday, and PM peak hour impacts could be mitigated via the same types of traffic engineering improvements described previously for this location.

Route 9A and Chambers Street

Significant traffic impacts at this location could not be mitigated via standard traffic engineering measures in any of the three traffic analysis periods. With the alternative set of less conservative trip generation and modal split assumptions, AM peak hour impacts would still not be mitigated, but there would be no significant impacts in the midday and PM peak hours.

Route 9A and Barclay Street

Significant impacts during all three traffic analysis hours could be mitigated via installation of a traffic signal at this currently unsignalized intersection, and with providing three westbound travel lanes along the westbound Barclay Street approach to the intersection. With the short bypass tunnel design for Route 9A, there would be no significant impacts requiring mitigation at this location.

Route 9A and Vesey Street

Significant impacts at this location could not be mitigated via standard traffic capacity improvement measures in the AM, midday, and PM peak hours. However, average vehicular delays would be substantially reduced as compared to conditions without the street direction changes as a result of eliminating the westbound approach to the intersection and making Vesey Street one-way eastbound east of Route 9A. (This is the same analysis conclusion made for year 2009 conditions, as well). With the short bypass tunnel design for Route 9A, impacts could be partially mitigated.

This intersection was also analyzed with the alternative set of less conservative trip generation and modal split assumptions. With the at-grade arterial design for Route 9A, impacts could not be mitigated via standard traffic engineering improvements. With the short bypass tunnel design, the impacts would be partially mitigated.

Route 9A and Fulton Street

Significant traffic impacts during all three traffic analysis hours could not be mitigated via standard traffic engineering improvement measures (overall conditions, however, are at LOS C in the midday peak hour and at LOS D in the PM peak hour). For conditions with the Proposed Action without the street direction changes outlined previously, there would be an unmitigatable impact in the AM peak hour but, by contrast to conditions with the street direction changes, there would be no impacts in either the midday or the PM peak hours. With the short bypass tunnel design for Route 9A, there would be no significant impacts.

This intersection was also analyzed with the alternative set of trip generation and modal split assumptions. With the at-grade arterial design for Route 9A, AM peak hour impacts would be partially mitigated, and significant impacts in the midday and PM peak hours would be fully mitigated. With the short bypass tunnel design for Route 9A, there would be no significant impacts.

Route 9A and Liberty Street

Significant traffic impacts could not be mitigated during the AM, midday, and PM peak hours; without the street direction changes, AM peak hour impacts were only partially mitigatable while midday and PM peak hour impacts were not significant and did not require mitigation. With street direction changes and the short bypass tunnel design for Route 9A, AM, midday, and PM peak hour impacts would be partially mitigated. With the alternative set of trip generation and modal split assumptions, AM and midday peak hour impacts would be partially mitigated; however, significant impacts in the PM peak hour would not be mitigated.

Route 9A and Brooklyn Battery Tunnel

Significant traffic impacts are projected and could not be mitigated for all three traffic analysis peak hours—the same conclusion as that reached for Proposed Action conditions without the street direction changes.

WASHINGTON STREET

Significant traffic impacts are not expected at the signalized intersection of Washington Street and Vesey Street nor at the unsignalized intersection of Washington Street and Rector Street.

GREENWICH STREET CORRIDOR

All three Greenwich Street intersections analyzed—at Fulton Street, at Liberty Street, and at Rector Street—would be significantly impacted in the AM and midday peak hours, while the Greenwich/Fulton and Greenwich/Liberty intersection would also be significantly impacted in the PM peak hour. All of these conditions could be mitigated via the same measures outlined for the Proposed Action without the street direction changes.

CANAL STREET

Both the Canal Street/Hudson Street ad the Canal Street/Varick Street intersections would be significantly impacted in all three traffic peak hours. (Two other Canal Street intersections—at Route 9A and at Broadway—are addressed within the "Route 9A Corridor" mitigation above and the "Broadway Corridor" mitigation below, respectively.)

Canal Street and Hudson Street

AM and PM peak hour impacts could be mitigated via standard traffic engineering measures, while midday peak hour impacts could only be partially mitigated using such measures (similar conclusions to those identified for Proposed Action conditions without the street direction changes). With the alternative set of trip generation and modal split assumptions, significant impacts in all three traffic analysis periods could be mitigated via standard traffic engineering measures.

Canal Street and Varick Street

Significant impacts in all three traffic analysis periods could be mitigated via signal timing modifications. With the alternative set of trip generation and modal split assumptions, there would be no significant impacts in the AM peak hour.

WEST BROADWAY CORRIDOR

Two of the four intersections analyzed along West Broadway would be significantly impacted in the AM and midday peak hours, and three of the four would be significantly impacted in the PM peak hour. At the West Broadway/Worth Street and West Broadway/Chambers Street intersections, the same types of traffic engineering measures cited as mitigation for Proposed Action conditions without the street conditions would be used for conditions with the street direction changes to successfully mitigate those impacts. At the West Broadway/Greenwich Street/Vesey Street intersection, signal timing changes alone would be able to mitigate the impacts; with the alternative set of trip generation and modal split assumptions, there would be no significant impacts during the three traffic analysis hours.

CHURCH STREET CORRIDOR

Six of the nine intersections analyzed along Church Street would be significantly impacted in the AM, seven would be significantly impacted in the midday peak hour, and eight would be significantly impacted in the PM peak hour. In general, the same types of traffic engineering measures would mitigate significant impacts for projected conditions with the street direction changes as were concluded for conditions without the street direction changes.

BROADWAY CORRIDOR

Three of the 10 intersections analyzed along Broadway would be significantly impacted during the AM peak hour, while just two intersections would be significantly impacted in the midday and PM peak hours.

Broadway and Worth Street

The same types of measures described under Proposed Action conditions without the street direction changes would also be able to mitigate impacts here in the AM and PM peak hours, while in the midday traffic analysis peak hour such measures could only partially mitigate the impacts (same conclusions as for the Proposed Action in 2015 without the street direction changes). With the alternative set of trip generation and modal split assumptions, the midday peak hour impacts could still only be partially mitigated.

Broadway and Vesey Street

AM peak hour impacts could be mitigated via parking prohibitions and lane re-striping along eastbound Vesey Street approaching the intersection plus signal timing modifications. In the midday and PM peak hours, impacts could only be partially mitigated. With the alternative set of trip generation and modal split assumptions, PM peak hour impacts could be mitigated via standard traffic engineering improvements.

Broadway and Rector Street

AM peak hour impacts could be mitigated using signal timing changes. There would be no midday and PM peak hour impacts.

WATER STREET

AM, midday, and PM peak hour impacts at the intersection of Water Street and Fulton Street could be mitigated by re-striping the northbound Water Street approach to the intersection to include one through lane and one shared through-left turn lane.

OVERALL STUDY AREA

Overall, standard traffic engineering measures with the proposed street direction changes would not be sufficient to fully mitigate expected significant impacts at five intersections in the AM peak hour, eight intersections in the midday peak hour, and six intersections in the PM peak hour. This represents one more unmitigated intersection in each peak hour than was identified for the Proposed Action without the street direction changes, although for at least one major intersection—Route 9A at Vesey Street—overall intersection delays would be substantially lower than for conditions without the street direction changes.

22.3.6 ADDITIONAL AREAWIDE TRAFFIC MANAGEMENT AND IMPROVEMENT STRATEGIES

In order to fully mitigate those impacts that could only be partially mitigated under the types of traffic capacity improvements described above, and in order to mitigate those impacts that are described as unmitigated above, additional areawide traffic management and improvement strategies would need to be considered.

Traffic management begins with a monitoring and understanding of traffic conditions that would actually occur once the Proposed Action is in place. It can include "intelligent transportation systems" (ITS) which have been, and continue to be, implemented along the major highway routes in the city, such as the Long Island Expressway, Cross Bronx Expressway, and others, as a means of monitoring traffic conditions and advising motorists of congested conditions ahead so that they can have the opportunity to modify their routes and avoid congested locations. ITS applications in Lower Manhattan could include opportunities to advise motorists as they approach Lower Manhattan via Route 9A, the Holland Tunnel, the FDR Drive, and the various East River bridge and tunnel crossings, of conditions ahead. It would also be possible to advise motorists of optimal locations for parking their cars before entering the core areas of Lower Manhattan and encourage them to divert off of Route 9A—expected to be the most congestion-prone route based on the analyses presented in this chapter and in Chapter 13A, "Traffic and Parking"—in advance of intersections that have been identified as being very difficult to mitigate by standard traffic engineering techniques *providing there are available parking facilities to "intercept" them before reaching the Project Site*.

Traffic management would also include promotion of the multitude of public transportation modes to divert would-be drivers out of their cars and into PATH, subways, buses, and ferry services including new commuter ferry services that have been suggested in Lower Manhattan. This could be accomplished by pricing strategies that dissuade motorists from driving into or out of the area at peak hours, and encourage them to use the "shoulder hours" of the peak (e.g., entering Lower Manhattan before 8 AM or after 9 AM, and leaving before 5 PM or after 6 PM), or pricing strategies that make it very costly for motorists to drive into Lower Manhattan at all, thereby encouraging them to take public transportation. Ticket packages to the Memorial and the performing arts center could include free or reduced fare mass transit as part of the package, as a uni-ticket with admission into the function being attended.

Consideration is also being given to making certain two-way streets into one-way streets and/or reversing the direction of some one-way streets to improve areawide traffic flow patterns. *One set of street direction changes was analyzed above in section 22.3.4, "Traffic Mitigation with proposed Street Direction Changes." The analysis showed that* one example under consideration is making Vesey Street one-way eastbound west of Church Street, to match its one-way eastbound configuration east of Church Street. This particular measure would improve congested conditions that are anticipated for the intersection of Route 9A and Vesey Street as per the Build and mitigation analyses conducted for this GEIS, *but it would shift some of the problems to parallel westbound streets. Yet a system of street direction changes shows considerable promise, and can be expanded and evaluated as planning for the Project Site continues*. This may occur in the near future as more information is developed and plans of the various city and state agencies are develop further. It is possible that one or more of the intersections identified as unmitigated or only partially mitigated in the preceding analyses could be significantly improved via these types of measures.

IMPLEMENTATION AND INTERAGENCY COORDINATION

Each of the traffic engineering improvements described above would require the approval of NYSDOT for geometric or signalization improvements along Route 9A, or NYCDOT or the New York Police Department (NYPD) for improvements at other (non-Route 9A) locations. In general, these improvements fall within the range of typical measures employed by these agencies in their ongoing efforts to maintain adequate traffic flow conditions, e.g., signal phasing and timing modifications, parking prohibitions, and intersection channelization improvements. Traffic enforcement agents are under the purview of NYPD, so communication with NYPD will be needed regarding the availability of enforcement agents to enforce the parking regulations cited in Chapter 13A.

Coordination with NYSDOT will be needed regarding the need for mitigation along the Route 9A corridor at intersections that are significantly impacted. NYSDOT is currently completing its own EIS for reconstruction alternatives for Route 9A in Lower Manhattan and, in the process, is utilizing a regional traffic methodology that is less conservative than the assumptions used in this GEIS (as described in Chapter 13A, section 13.2.4, “Trip Generation Procedures”). That is because the Route 9A Project is using a constrained traffic capacity model that limits the volume of traffic added to Route 9A up to the point that the corridor’s capacity is fully used. The Route 9A model assumes that, once capacity is reached, additional vehicles will divert either to other traffic routes, to the “shoulder hours” of the peak period (i.e., just before or just after the peak hour itself, where some residual capacity may be available), or to alternative modes of transportation, such as subways or buses. By contrast, this GEIS more conservatively assigns traffic demand to the corridor to which it would most likely be attracted to but not to other roadways, non-peak hours, or other travel modes.

It is expected that NYSDOT will review the findings of this GEIS as worst-case projections for the corridor—since this GEIS’s analysis procedures included a higher future traffic volume—and evaluate the potential to increase Route 9A corridor capacity at critical intersections in order to be able to incorporate the mitigation recommendations of this GEIS to the extent practicable. Where such mitigation (or a comparable substitute) is deemed not to be necessary or feasible by NYSDOT, the adverse impacts in question could remain unmitigated.

22.4 PEDESTRIAN CONDITIONS

In 2009, *eight* crosswalks would have significant impacts as a result of the Proposed Action (see Table 22-2). These impacts could be mitigated by widening the crosswalks *at five of these locations*. The other *three* crosswalks could not be fully mitigated but could be widened to a maximum of 20 feet to minimize the effect of the Proposed Action.

Table 22-2
Future with the Proposed Action—Current Conditions Scenario
2009 Crosswalk Mitigation

Intersection	AM Period Crosswalk				Midday Period Crosswalk				PM Period Crosswalk			
	North	East	South	West	North	East	South	West	North	East	South	West
Church @ Vesey St.		X				O				X		X
Broadway @ Fulton St.		O								O		
Church St. @ Liberty St. (without underground connection)	O											
Greenwich St. @ Liberty St.								O				

Notes: O – mitigatable impact; X – unmitigatable impact
Sources: Louis Berger Group, Inc., 2003.

In 2015, the Proposed Action would result in significant impacts at *13* crosswalks, *seven* of which could be mitigated by widening the crosswalks (see Table 22-3). The other *six* crosswalks that could not be fully mitigated could be widened to a maximum of 20 feet to minimize the effect of the Proposed Action. Although the Proposed Action would cause some unmitigatable crosswalk impacts in 2009 and 2015, pedestrians will be able to cross streets at these crosswalk locations with slightly more peak hour congestion but with little or no appreciable change in crossing time.

Table 22-3
Future with the Proposed Action—Current Conditions Scenario
2015 Crosswalk Mitigation

Intersection	AM Period LOS Crosswalk				Midday Period LOS Crosswalk				PM Period LOS Crosswalk			
	North	East	South	West	North	East	South	West	North	East	South	West
Church St. @ Vesey St.		X		O		O				X	O	O
Broadway @ Fulton St.		O								O		
Church St. @ Liberty St. (without underground connection)	X											
Greenwich St. @Liberty St.				X				X				X
W. Broadway @ Vesey St.								O				

Notes: O – mitigatable impact; X – unmitigatable impact
Sources: Louis Berger Group, Inc., 2003.

22.5 NOISE

Although it is expected that the peak construction period would range between 2006 through 2008, construction operations, such as those for upper floors of the Towers 2, 3, and 4, and initial construction of Tower 5, would continue at the Project Site in 2009. The proposed Memorial and parks at the street level would be completed and operational by 2009. Due to the proximity to the Memorial and parks as well as adjacent residences, significant noise impacts at these noise sensitive sites during construction will be unavoidable in 2009 (see Table 22-4).

Table 22-4
Overview of Noise Impacts and Mitigation of Construction Activities in 2009 for Various Components and Locations

Construction Activities	Possible Locations	Types of Activities		Typical Equipment Utilized	Typical Time of Operation	Duration	Airborne Noise Impact	Typical Equipment Noise Emission Levels (dBA)	Mitigation Measures
High Rise Office Tower Construction	Construction of five high-rise commercial office towers that will reinstate over 10 million square feet of office space on the site	Foundation and super-structure	Above Ground Below grade	Cranes, Concrete pump, Trucks, Generators, Tractor trailer, etc.	10 hrs between 7:00 and 6:00	various	S	88 dBA	Work would not occur late night; Noise curtains on the side of the structure/ sheds/enclosures would be employed.
Materials Delivery by Truck	Demolition and below-grade excavation sites, staging areas, truck routes excavation sites	Trucks traveling to and from sites, Loading and Unloading	Mostly below grade in Bathtub	Trucks, Loader	10 hrs between 7:00 and 6:00	Various	S (Significant noise impact where loading and unloading takes place; no significant noise impact on road/river network)	88 dBA	Work would not occur late night; 2 cy of soil will be placed in truck body prior too loading excavated material to replace rock impact noise.
Staging Area	Streets and sidewalk	loading/unloading, storage	On surface	Concrete pumps, loads, cranes, etc.	10 hrs between 7:00 and 6:00	various	S	85 dBA	Fit crane with silencer; Use of flagmen or manually adjustable alarms to reduce back-up alarm noise; Noise enclosures and/or other mitigation measures would be employed.

Notes:
S- Significant for noise and/or vibration;
NS- Not significant for noise and/or vibration;

Source: The Louis Berger Group, Inc., 2003.

It should be noted that at several locations, existing ambient noise levels prior to September 11 were already above those specified in CEQR and FTA and HUD impact criteria and continue to be so under existing conditions. Consequently, reducing construction noise to below such impact criteria levels would not be practicable because the construction noise would still be exceeded by the ambient noise levels. The dense, urban setting with mixed uses makes developing and implementing cost-effective, feasible mitigation measures a challenge.

LMDC is committed to implement measures to reduce significant noise impacts resulting from construction. These commitments include LMDC's *Sustainable Design Guidelines* (see current draft in Appendix A) and the Environmental Performance Commitments (EPCs). More specifically, guideline SEQ-5 calls for the development and implementation of a Construction Environmental Protection Plan prior to construction. That plan's components are described in the "Construction" section of this chapter, which summarizes the wide array of construction noise reduction strategies that LMDC and the Port Authority will explore during the construction peak year of 2006. Those same options would be explored for 2009 as well, in order to reduce the construction component of ambient noise to the lowest practicable level.

22.6 CONSTRUCTION

In addition to the avoidance measures identified for Archaeological Resources identified above, construction period mitigation measures would be needed for the traffic, air quality, and noise impacts identified in Chapter 21, "Construction."

22.6.1 TRAFFIC

It was conservatively assumed that two lanes would be closed throughout the Church Street and Broadway corridors, including at major intersections, during the NYCDOT roadway reconstruction project. As shown in Table 21-9, significant traffic impacts are expected along Church Street and Broadway during the AM, midday, PM peak hours due to construction activity from the Proposed Action and the other major Lower Manhattan projects. These impacts could be mitigated by coordinating with NYCDOT to close only one lane at a time within its work areas at major intersections along Church Street and Broadway. The additional lane could be used to provide an exclusive turning lane at these locations during the construction period.

Additional green time could be provided for the westbound approach at the Vesey and Route 9A intersection to mitigate the identified impact during the AM peak hour. The impact identified during the midday peak hour on the westbound approach of the Cortlandt Street and Church Street intersection could be mitigated by providing a dual right turn lane from Cortlandt Street.

Maintaining access to local businesses and points of interest, such as the WTC Site itself, to the greatest extent practicable is recognized as an essential element of the construction plan. Staging areas for trucks that would limit the impact on adjoining neighborhoods are also contemplated by those guidelines. Sidewalk closures around the perimeter of the WTC Site due to construction and staging activities would also require mitigation.

PEDESTRIANS

Maintaining access to local businesses and points of interest such as the WTC Site itself for all pedestrians, including residents, tourists, and other visitors to the greatest extent practicable is recognized as an essential element of the construction plan.

To achieve this, pedestrian flow along Vesey and Liberty Streets would be maintained throughout the duration of construction except during limited periods of construction will require temporary closures. All closures will be kept to a minimum as much as possible. Such actions would implement an element of the *Sustainable Design Guidelines*, specifically, the SEQ-5 Construction Environment Plan, which calls for the project sponsor to "avoid or minimize impacts and communicate plans with the public" as well as to "prepare contingency measures in the event established limits are exceeded."

Where activities require the closure of certain segments around the perimeter of the WTC Site, appropriate measure would be taken to offset such loss. For example, construction and staging activities proposed along the east side of the WTC Site between Liberty Street and Vesey Street would require the use of a portion of the existing west side sidewalk on Church Street. To mitigate the loss of sidewalk space at this location, the western curb lane on Church Street between Liberty Street and Vesey Street will be added to the remaining sidewalk to provide the requisite pedestrian flow.

In addition to the Construction Environment Plan (SEQ-5), the EPCs pertaining to Access and Circulation would be employed during construction. Such measures include:

- Development and implementation of project-specific pedestrian and vehicular Maintenance and Protection plan;
- Promoting public awareness through mechanisms such as: signage; telephone hotline; and web site updates;
- Ensuring sufficient alternate street, building, and temporary and permanent WTC PATH Terminal and subway station access during construction period; and

Maintaining regular communication with NYCDOT and participation in its construction coordination efforts.

22.6.2 AIR QUALITY

AVAILABLE MITIGATION MEASURES

Although planned measures to reduce the emission of particulate matter *(PM)* from construction activities have been incorporated into the existing Proposed Action and taken into account in this analysis, significant adverse *PM* impacts have been predicted in the vicinity of the site. Since the cumulative impact from the other major projects are predicted to impact air quality in the same area, further coordinated action would be necessary to minimize the emission of particulate matter from all construction activities.

The plan for all major Lower Manhattan reconstruction projects, *as stated in the EPCs,* include*d* the use of ULSD for all engines, and emission reduction technologies for all engines 60 HP and larger. *The* analysis *of the plan, presented in Chapter 21, "Construction," applied* an estimated minimum PM emissions reduction of 40 percent to all such engines, based on the lowest reduction achieved by the available technologies. Diesel oxidation catalysts (DOC) achieve this reduction, with the added benefit of a significant reduction in the emission of VOCs. *However, based on the analysis in Chapter 21, substantial additional reductions beyond those contemplated by the EPCs would be needed to assure compliance with air quality standards. The major categories of measures that could be employed to achieve greater reductions in* *localized PM emissions are (1) electrification, (2) advanced reduction technologies, and (3) newer engines.*

- ***Electrification:*** *Certain construction engines which operate in a fixed position or temporarily fixed position, such as welding machines and compressors, could potentially be connected to a grid based power source. Provided that temporary connection to the power grid is made available by Con Edison at the start of construction, providing sufficient power to the sites, some such equipment could operate on direct power, thus eliminating the on-site diesel exhaust source. In some cases this may not prove effective due to the need for flexibility and there may be instances where some local generation would be needed when access to connection points is not feasible. However, LMDC has determined that the Proposed Action can replace much of the on-site power generation with grid power, thus minimizing the onsite generation capacity and significantly reducing diesel operated welding machines and compressors. This assumption was not made for other Lower Manhattan Recovery projects, however, because continued access to electricity may or may not be feasible.*
- ***Advanced Reduction Technologies:*** *In addition to the DOCs, which were applied to the project, other tailpipe emission technologies are available which can achieve reductions in PM emissions of 85 percent and as high as 98 percent more, such as diesel particle filters (DPF). DPFs are not effective for every type of engine operation and there may be technical difficulties in applying DPFs to some engines. The existing DPFs which have been verified by EPA or by the California Air Resources Board (CARB) as effective at significantly reducing PM emissions are mostly dependent on a high operational exhaust temperature for part of the operational cycle in order to regenerate the filter and enable the continued operation of the engine. In some cases of construction engines that requirement is not met. DPFs with other means of regeneration exist, but would need to be tested for the specific desired applications. Procedures for verifying the use of these technologies would need to be identified and implemented. Also, it is possible that first application costs of cutting edge diesel reduction technology may prove to be prohibitive.*
- ***Newer Engines:*** *the use of new construction engines could ensure that older, higher emitters are not operating on-site, and would make the operation of added control technologies easier and more efficient. For example, DPFs do not generally function with engines manufactured prior to 1994/5 since those engines did not include fuel injection. Since newer engines tend have lower emissions to begin with, tailpipe reduction technologies would function more efficiently.*

The effectiveness of measures to reduce PM emissions depends on compliance. To that end, verification procedures would be necessary to ensure the use of ULSD, maintenance of reduction technologies, dust suppression programs and the use of grid power.

MITIGATION FOR THE PROPOSED ACTION

In addition to the EPCs, a combination of the above mitigation measures would be in place for the Proposed Action. LMDC is continuing to review with agencies responsible for the other Lower Manhattan Recovery Projects their ability to make similar commitments with respect to some or all of these additional measures. Although the precise commitments to be made by these agencies have not yet been determined, it is expected that, through a combination of *these or other comparable measures, such agencies would achieve the benefits described below.*

MODELING ASSESSMENT OF MITIGATION SCENARIO

With a commitment by all of the major reconstruction projects to implementing a combination of the above-mentioned mitigation measures, projected PM emissions from construction equipment could be substantially reduced. The effectiveness of such mitigation has been assessed by modeling a mitigation scenario for both the Proposed Action and the cumulative construction of the Lower Manhattan Recovery Projects.

Methodology

The general methodology for this analysis follows the procedures described for the analysis of air quality impacts from construction presented in Chapter 21. The precise emissions reduction for each engine type is not yet known, since some of the applications suggested have yet to be tested and are currently under investigation by the project sponsors of the Lower Manhattan Recovery Projects. However, existing information suggests that DPF level reduction is technically achievable for most engines types that would be operating on the sites. For the purpose of this assessment, it was assumed that 75 percent of engines of 50 HP or greater would be able to employ DPFs or other equivalent technologies achieving a reduction of 90 percent in PM emissions. The remainder, 25 percent, was assumed to employ DOCs or other equivalent technologies reducing 40 percent of the PM emissions.[1] These reductions include the reduction in PM emissions due to the use of ULSD. As discussed in Chapter 21, all smaller engines would be using ULSD and achieve a 14 percent reduction in PM as compared to the emissions predicted with normal nonroad fuel.

In addition, for this assessment, emissions from the Proposed Action reflected a reduction in the use of diesel-powered generators, welders and compressors as a result of temporary connection to grid power at the outset of construction. This measure would result in a reduction in all pollutants emitted from diesel engines, including NO_x as well as PM, and resulted in lower predicted concentrations of NO_2, as well as PM_{10} and $PM_{2.5}$. Since detailed information regarding the availability of power and the engines that could be electrified was not yet available, no further reductions for electrification were assumed for the other Lower Manhattan Recovery Projects. If those other projects also replace diesel power with temporary connections to the grid, additional reductions in concentrations could be achieved, especially in NO_2. A detailed description of the revised construction assumptions is presented in Appendix J.

Analysis Results

The highest predicted microscale (local) increase in pollutant concentrations at various types of locations due to mitigated construction activity of the Proposed Action, and the mitigated

[1] *This assumption for modeling purposes was based on research indicated that most diesel equipment over 150 hp has the capability to successfully employ DPFs, while fewer pieces of equipment in the 50–150 hp range are able to do so. The majority of the projects' air emissions from construction equipment are released by engines over 150 hp.*

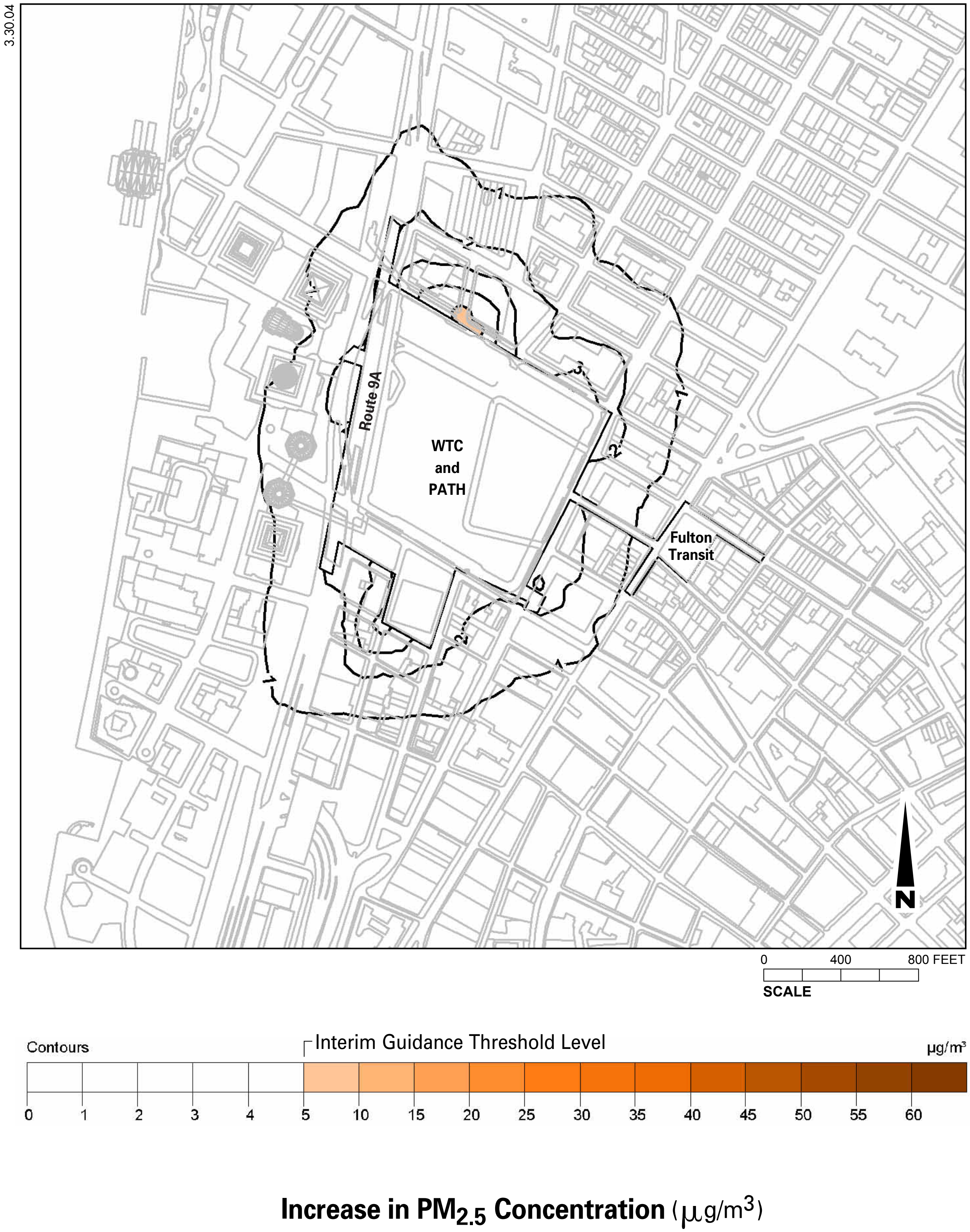
cumulative impact of all Lower Manhattan Recovery Projects combined are presented in Table 22-5, and in Figures 22-13 through 22-18. The concentrations at locations adjacent to the construction sites include contributions from both on-road sources and on-site construction activity emissions. The concentrations marked "Other locations Along Access Routes" represent the highest predicted impacts from on-road sources at more distant locations that would not be impacted by the construction activity on-site. Total concentrations, including background levels, are presented in Table 22-6.

Table 22-5
Highest Predicted Total Increase in Pollutant Concentrations

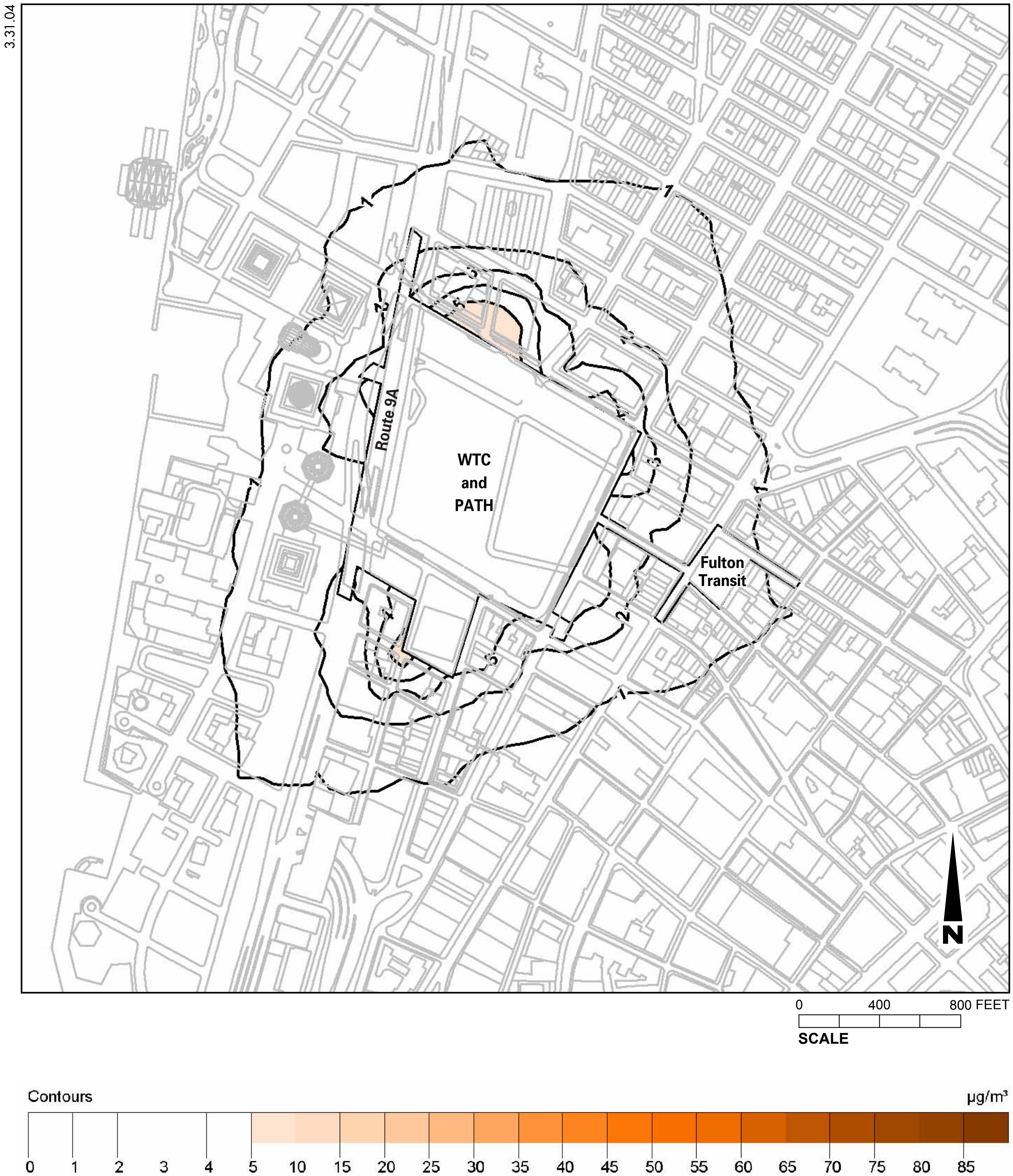
Pollutant	Average Period	Benchmark [µg/m³] *	Receptor Type	Maximum Increase [µg/m³]	
				Proposed Action	Cumulative
NO_2	Annual	Not Applicable	Highest—All Receptors	17.1	27.2
			Residential only	17.1	24.1
$PM_{2.5}$	24-hour	5.0	Highest—All Receptors	6.3	26.6
			Residential only	3.6	14.3
			Other Locations on Access Routes	0.3	0.4
	Annual**	0.1	Construction Area	0.07	0.55
			Other Locations on Access Routes	0.04	0.06
PM_{10}	24-hour	Not Applicable	Highest—All Receptors	10.0	38.9
			Residential	8.1	19.3
			Other Locations on Access Routes	4.4	4.5
	Annual	Not Applicable	Highest—All Receptors	2.15	2.98
			Residential	1.36	2.18
			Other Locations on Access Routes	1.41	1.42

Notes:
** Benchmark levels are NYCDEP interim guidance and NYSDEC draft policy threshold levels. For determination of potential impacts, these interim threshold values are compared to the Proposed Action only.*
*** Annual $PM_{2.5}$ concentrations are neighborhood scale.*

The maximum predicted $PM_{2.5}$ increments presented above are significantly lower than those predicted for the base case, in Chapter 21. Maximum predicted $PM_{2.5}$ increments of the Proposed Action would be reduced by mitigation to levels on the order of the thresholds defining significant increases. More important, as can be seen in Fig. 22-16, the extent of peak increments which could lead to exceedances of the 24-hour NAAQS for $PM_{2.5}$ could be reduced to a single location adjacent to the site boundary, along the West Street bikeway. The occurrence of such an exceedance would depend on the coincidence of peak background levels above the 98th percentile together with peak construction activity and the extreme meteorological conditions that led to the concentration predicted in the model. Such an occurrence, although possible, is not likely and in any event would be rare. This would be a temporary situation, limited to a small area immediately adjacent to the Route 9A construction site and would not be expected to occur in subsequent years during which construction activity would be reduced.



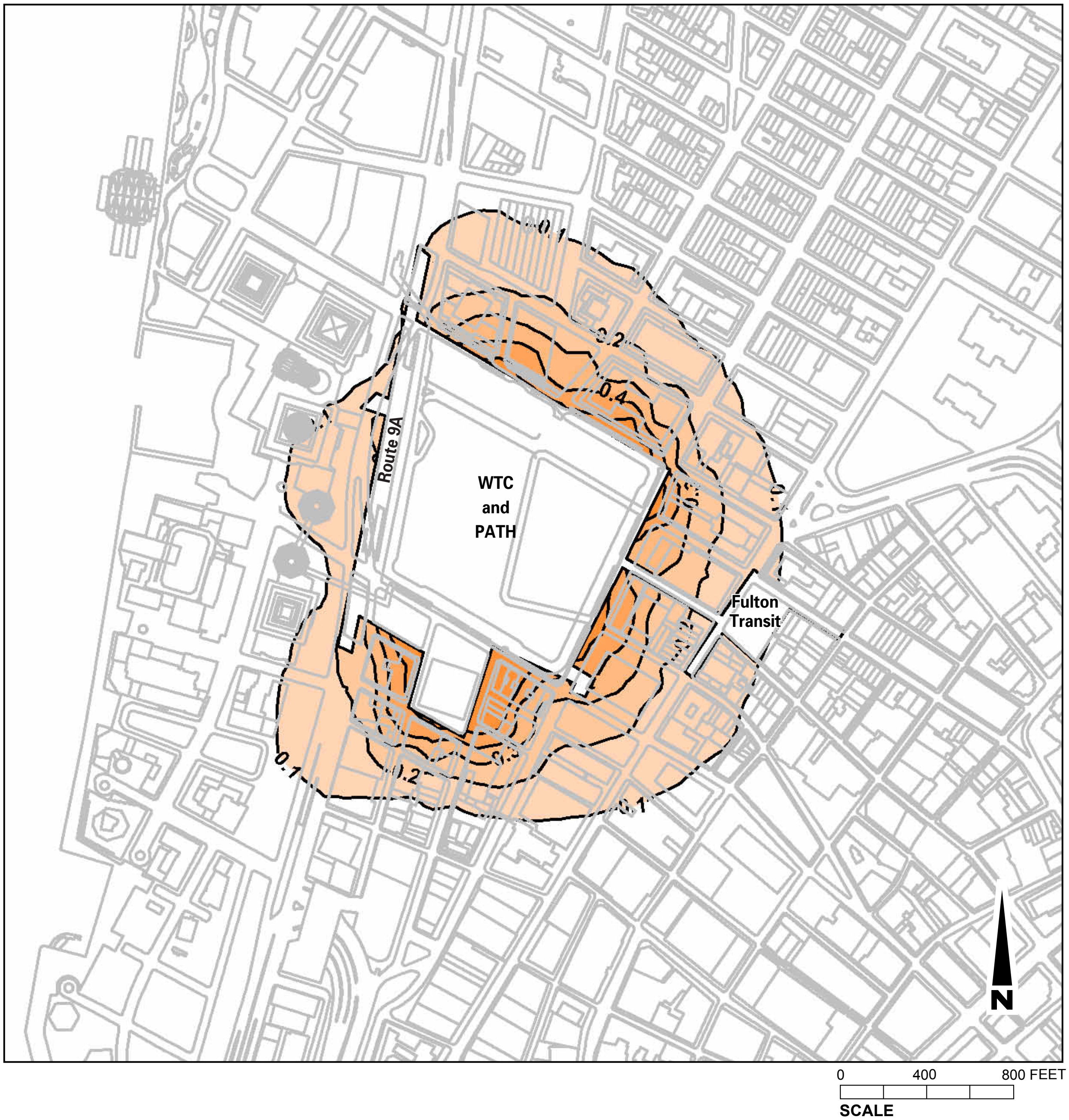
Maximum 24-Hour Average
$PM_{2.5}$ Construction Increment
WTC Only
Figure 22-13

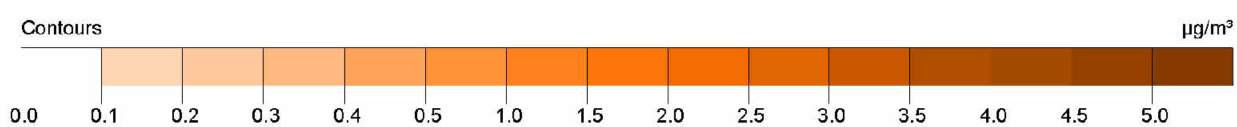


Increase in PM_{10} Concentration ($\mu g/m^3$)

Maximum 24-Hour Average
PM_{10} Construction Increment
WTC Only
Figure 22-14

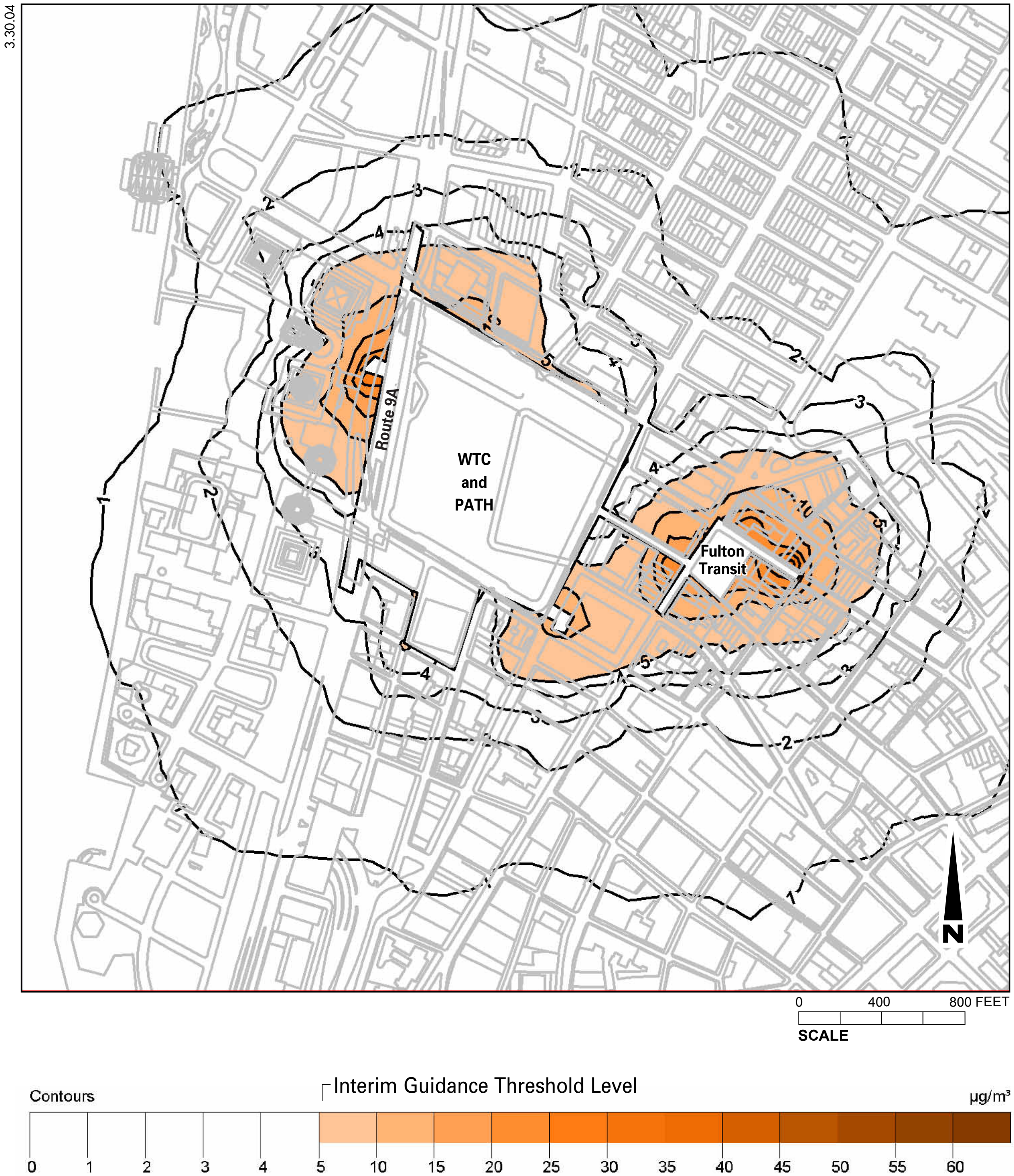
3.30.04





Increase in PM_{10} Concentration ($\mu g/m^3$)

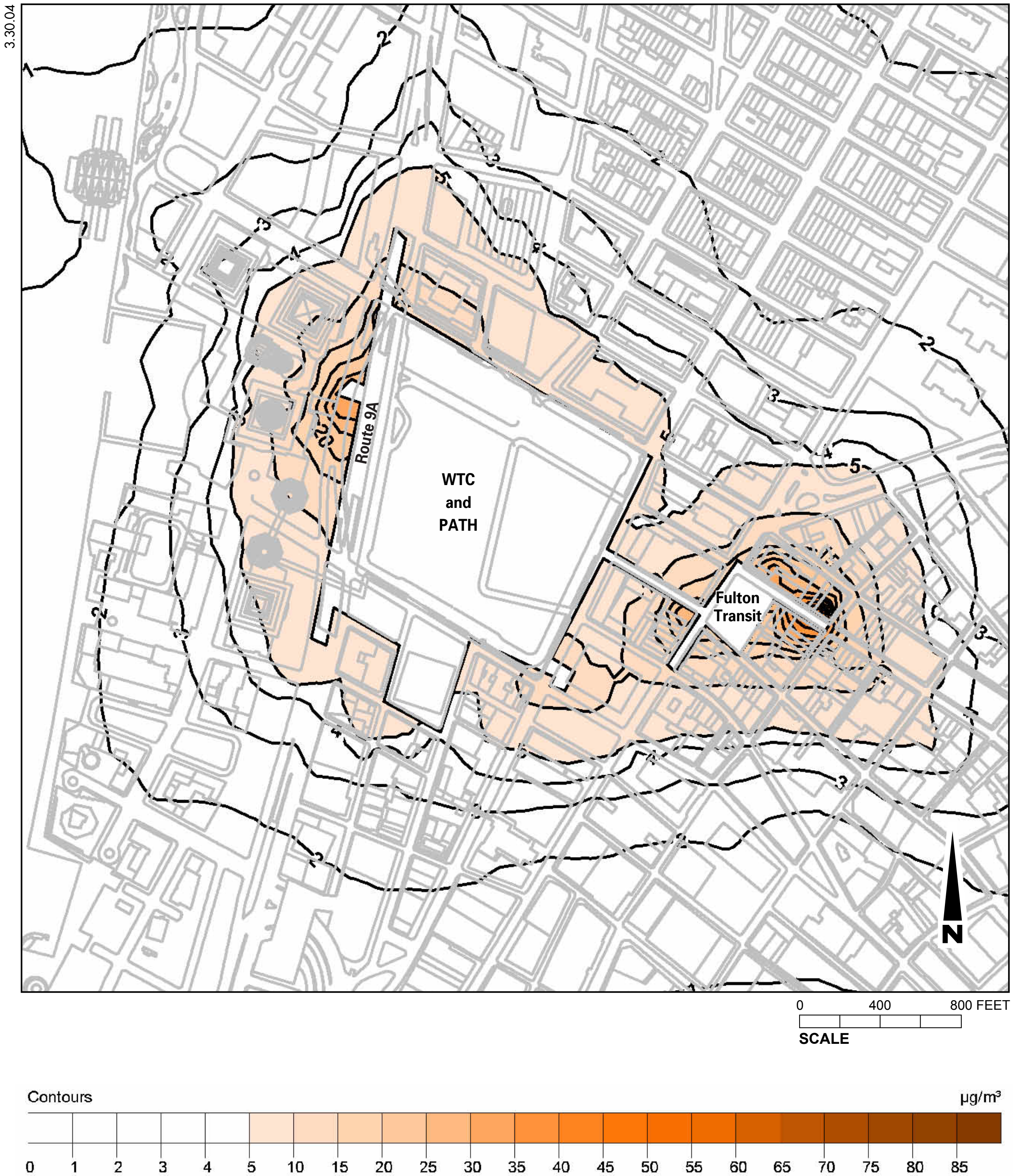
Maximum Annual Average
PM_{10} Construction Increment
WTC Only
Figure 22-15



Increase in $PM_{2.5}$ Concentration ($\mu g/m^3$)

Maximum 24-Hour Average $PM_{2.5}$ Construction Increment Cumulative

Figure 22-16

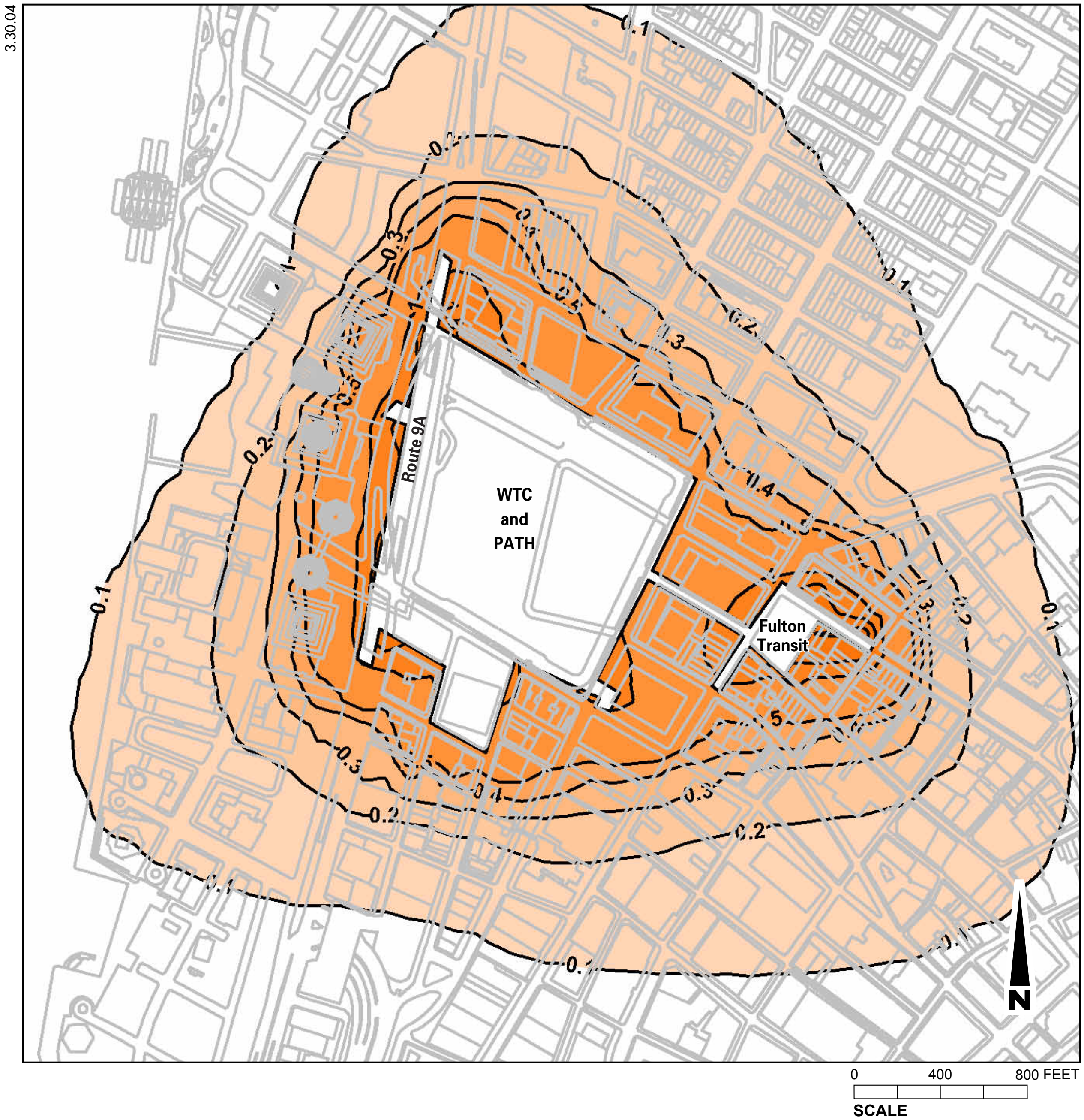


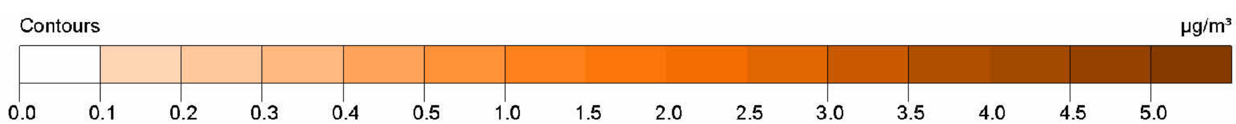
Increase in PM_{10} Concentration ($\mu g/m^3$)

World Trade Center Memorial
and Redevelopment Plan

Maximum 24-Hour Average
PM_{10} Construction Increment
Cumulative

Figure 22-17





Increase in PM_{10} Concentration ($\mu g/m^3$)

Maximum Annual Average
PM_{10} Construction Increment
Cumulative
Figure 22-18

Table 22-6
Highest Predicted Total Particulate Matter Concentrations

Pollutant	Average Period	NAAQS [μg/m^3]	Receptor Type	Maximum Concentration [μg/m^3]	
				Proposed Action	Cumulative
NO_2	Annual	100	Highest—All Receptors	89.1	99.2
			Residential only	89.1	96.1
$PM_{2.5}$	24-hour	65	Highest—All Receptors	53.2	73.6
			Residential only	49.2	60.7
			Other Locations on Access Routes	48.1	48.1
	Annual*	15	Construction Area	17.25	17.77
			Other Locations on Access Routes	17.14	17.16
PM_{10}	24-hour	150	Highest—All Receptors	70.5	99.3
			Residential	60.8	73.5
			Other Locations on Access Routes	63.7	63.6
	Annual	50	Highest—All Receptors	29.3	30.5
			Residential	26.9	28.8
			Other Locations on Access Routes	28.8	28.8

Notes:
* Annual $PM_{2.5}$ concentrations are neighborhood scale.
All total concentrations include background contributions from local mobile sources, as well as regional background values as follows:
NO_2—Annual average 72 μg/m^3.
PM_{10}—Annual average 22 μg/m^3; 24-hour average 50 μg/m^3.
$PM_{2.5}$—Annual average 17.1 μg/m^3 (highest of 2000-2002 annual values); 24-hour average 44.0 μg/m^3 (highest of the three 2nd highest 24-hour averages in 2000-2002).
Cumulative and Proposed Action maximum concentrations may occur at a different time and/or location.

If necessary to avoid exposing residents to short-term exceedances of the PM NAAQS, LMDC will investigate the implementation of location specific measures, such as the installation of HEPA filters at fresh air inlets in hotels and office buildings, and the purchase of air conditioning units with HEPA filters for residences with operable windows, in the immediate vicinity of the project site.]

As described in this chapter above, LMDC will continue to coordinate with the agencies funding and sponsoring major reconstruction projects in Lower Manhattan with the objective of further reducing combined PM emissions from the Proposed Action and those projects. With these commitments to controlling the emission of PM from construction activities, PM emissions would be reduced to the extent currently practicable.

22.6.3 NOISE

As a result of the ongoing construction activities from various projects during the peak construction year in 2006 *and in the years following, including the Memorial opening in* 2009, significant noise impacts are unavoidable at receptor locations in the immediate vicinity of the Project Site. Due to the proximity of the Project Site to sensitive land uses (including residential land uses, parks, and the Memorial) the concurrent construction of several large-scale projects within a small geographic area (WTC Memorial and Redevelopment, permanent WTC PATH Terminal, Route 9A, and Fulton Street Transit Center) and the duration of multiple ongoing construction projects, significant noise impacts during construction *would* be unavoidable. These impacts would occur for a considerable period of time—several years for the construction of the

Memorial and Freedom Tower, and up to 10 years for the Towers 2, 3, 4, and 5 at the Project Site.

This section presents information on potential measures to be employed to mitigate noise impacts. It should be noted that at several locations, existing noise levels prior to September 11 were already above those specified in CEQR, FTA, and HUD impact criteria and continue to be so under existing conditions. Consequently, reducing construction noise to below such impact criteria levels would not be practicable because the construction noise would be exceeded by the ambient noise levels. Finally, the dense urban setting with mixed uses makes developing and implementing cost-effective feasible mitigation measures a challenge.

It is noted that the analysis for the proposed Memorial Area receptor location (location No. 24) was conducted assuming the Route 9A Reconstruction Project at-grade alternative, an alternative that would produce higher noise levels at the receptor than the short bypass alternative. As a result, the projected ambient noise levels in year 2009 would exceed HUD standards for noise-sensitive receptors. If the short bypass alternative is chosen, noise levels at location No. 24 would be reduced, possibly below HUD standards.

Various mitigation strategies are being considered to limit the potential impact of noise *generated by construction activities.* These strategies are being developed by LMDC *and other members of the Lower Manhattan Construction Coordination Group (LMCCG), whose members include* sponsors of the other major Lower Manhattan Projects *(the Port Authority, MTA NYCT, and NYSDOT) and other project sponsors and key stakeholders including HUD, FTA, FWHA, NYCDOT, NYSDEC, NYCDEP, and Silverstein Properties.*

In recognizing that it is beneficial that construction be coordinated to ensure that projects move forward expeditiously while minimizing the impact to residents, businesses, workers, commuters, pedestrians, and vehicles, the LMCCG's mission is to:

- *Coordinate the rebuilding process and ensure that the construction in Lower Manhattan proceeds as scheduled by mediating conflicts in schedules and street and site access between construction projects, agencies, and the Lower Manhattan community.*
- *Institute construction coordination protocols and guidelines for all government agencies, developers, construction managers, subcontractors, general contractors, and utility companies to follow for all Lower Manhattan construction projects.*
- *Coordinate the activities between individual projects during the planning process and on a daily basis throughout construction.*
- *Plan the construction projects to minimize inconvenience and maintain access for residents, workers, businesses, pedestrians, vehicles, and commuters.*
- *Ensure that the Lower Manhattan area maintains the highest degree of order and quality of life throughout construction.*
- *Develop and utilize technology to facilitate coordination of projects construction activities.*

In effect, the LMCCG would create an entity or strategy to enforce the Environmental Performance Commitments (EPCs) to avoid, minimize, and mitigate potential impacts and further refine them as necessary. As part of the Proposed Action, the EPCs seek to minimize noise levels during construction. The LMCCG would develop specific measures to carry out its *mission. Measures would include developing a Construction Environment Plan for each project subject to the EPCs.*

Separately from the EPCs, LMDC and the Port Authority are committed to implementing measures to reduce significant noise impacts resulting from construction through the *Sustainable Design Guidelines (see Appendix A)*. More specifically, guideline SEQ-5 calls for the development and implementation of a Construction Environment Plan prior to construction that could include the following elements:

- Implementation of a materials staging and construction access plan to reduce noise and vibration in adjoining neighborhoods;
- Use of noise barriers (where appropriate);
- Scheduling and coordination with other Lower Manhattan construction activities; and
- Preparation of a contingency plan in case established (criteria) limits are exceeded.

While not a part of the *Sustainable Design Guidelines,* other strategies being considered include:

- Use of alternative construction methods;
- Development of enhanced construction specifications *that take noise into consideration.*

In coordination with the entity developed by the LMCCG, LMDC, the Port Authority, and Silverstein Properties the measures noted above would be implemented through the project-specific Construction Environment Plan. *The plan would* be developed prior to construction of the Proposed Action and would reflect the most recent designs and construction plans. It would be updated continuously as the project schedule and activities evolve during construction. An overview of potential elements of the Construction Environment Plan is presented below.

EMISSION LIMITS AND PERFORMANCE STANDARDS

Construction of the Proposed Action would be limited to between 7 AM and 6 PM, Monday through Saturday, as practicable. Noise from construction equipment is regulated by EPA noise emission standards and also specified in New York City Noise Code. These mandate that certain classifications of construction equipment, e.g., air compressors, pavement breakers, and heavy trucks, meet specified noise emission standards. The entity developed by the *LMCCG* would ensure that this regulation would be carefully followed.

In addition, construction noise performance standards may be established by the LMCCG and LMDC and other agencies for locations of sensitive receptors adjacent to specific project sites. Project sponsors would include such standards in construction contract documents for its projects. Performance standards may include construction noise level thresholds for daytime, evening, and nighttime hours *for weekday, weekend and holiday periods* at sensitive *receptor locations* at and/or adjacent to a project site. These threshold criteria would include hourly L_{eq} and L_{10} during the various time periods, and may also include 8-hour L_{eq} and 30-day L_{dn} levels, consistent with agency guidelines for construction noise.

DESIGNATED TRUCK ROUTES

In general, because the project area has relatively high airborne noise levels due to existing traffic volumes, the increase in noise levels caused by delivery trucks and workers traveling to and from the construction sites would not be perceptible. However, localized increases in noise levels would be expected in the immediate vicinity of the Project Site near a few defined delivery truck routes and streets, e.g., Barclay and Liberty Streets. Since all truck trips would be restricted to the designated truck routes, it is anticipated that noise impacts associated with construction related traffic would be limited to the receptor sites located on Barclay and Liberty Streets.

NOISE MONITORING

Prior to construction, *background* noise measurements will be taken at noise-sensitive locations, in addition to the noise measurements conducted during the environmental review process. After construction begins, these stations *could be used by project sponsors* to monitor contractors to ensure that the performance standards established by *the individual agencies* are met. Throughout construction, all contractors working on LMDC-funded projects at the Project Site may be required to meet the performance standards, procedures, and conditions specified in the Construction Environment Plan.

DESIGN CONSIDERATIONS AND PROJECT LAYOUT

Design considerations and project layout approaches outlined in this section would be beneficial to mitigating impacts from Lower Manhattan Recovery projects. Such measures include constructing temporary noise barriers, rerouting traffic, placing construction equipment farther from noise-sensitive receptors, *maximizing the distance between noisy activities,* and constructing walled enclosures/sheds around especially noisy activities. There are several mitigation measures that have the potential to significantly reduce project impacts:

- The use of acoustic barriers and walled enclosures around certain construction activities. For example, noise tents/enclosures could be used around workers using jackhammers. A temporary noise barrier of appropriate height could be installed along the fence line/property line of the Project Site to reduce the noise levels. In addition, temporary barriers e.g., wood panels on top of Jersey barriers could also be positioned adjacent to and moved along slurry wall and other construction operations.
- The placement of construction equipment in shielded locations, such as below grade in the bathtub of the Project Site, if possible. It is expected that most of the delivery and loading activities would occur inside the bathtub during foundation and sub-grade construction. The edge of the slurry wall would thus provide noise shielding for the receptors on the street levels.
- The installation of *noise reducing components* on jackhammers, air compressors, generators, light plants, *pile drivers* and cranes to reduce noise levels.
- The use of electrically operated equipment, rather than combustion equipment, wherever possible; *use of new models of equipment with quieter engines; or the "right-sizing" of equipment, especially generators, to minimize noise from unnecessarily larger pieces of equipment.*
- The use of soil beds, timber planking, *resilient surface coatings,* and/or exterior rubber lining on truck bodies, *wheel barrows, and concrete buggies* to reduce rock impact noise during truck load/unloading operations.
- The use of drive-through street-level truck enclosures for truck loading and unloading.

- The use of sheds/enclosures at concrete pump sites during concrete truck unloading.
- The placement of most loading/unloading inside the bathtub and away from areas on the streets levels, if possible.
- *The designation of central areas within projects for noisy activities, such as cutting steel or wood or use of noisy equipment such as impact wrenches. Encourage use of pre-cut, pre-fabricated, or modular construction materials that minimize need for on-site fabrication or cutting methods.*

Overall, the implementation of such measures would reduce the number of adverse airborne noise impacts, but is unlikely to eliminate all of them. Even with these measures construction operations would create significant adverse airborne noise impacts at a number of locations—in particular, at various residences adjacent to the Project Site.

SEQUENCING OF OPERATIONS

Sequencing operations among the Proposed Action and other Lower Manhattan Recovery projects could reduce noise impacts by either combining noisy operations to occur in the same time period or spreading them out, avoiding sensitive times of the day (nighttime activities) or sensitive days of the year (e.g., September 11). This approach requires a highly coordinated effort.

LMDC, the Port Authority, and other appropriate project sponsors and other entities such as the NYC Department of Transportation would coordinate efforts to explore which construction operations can be limited to daytime operations only, without significantly affecting schedule and costs.

Project sponsors could also unilaterally schedule the noisiest construction activities such as building slurry walls, pile driving, and surface excavation to daytime hours or less sensitive days unless these activities were enclosed or far away from *noise*-sensitive *locations*, such as residences.

Other activities, however, may not have as much latitude in scheduling, such as utility work. Because utility work requires the complete closure of the roadway and shutting off utility service for several hours, utility work is normally undertaken at night. Some cut and cover construction would be needed, and noisy equipment, such as jackhammers, would at times be required. Where practicable, work would occur during the day. Moreover, late evening construction would occur during a limited number of evenings over the course of a year, which is the expected length of utility relocation work at a site.

ALTERNATIVE CONSTRUCTION METHODS

Alternative construction methods, using special low noise emission level equipment, and selecting and specifying quieter demolition methods would also be included in the Construction Environment Plan. While impact pile driving is currently not anticipated, if such needs were to arise, alternative methods would be considered

The use of alternative construction methods would reduce the need for particularly annoying and disturbing operations such as the use of backup horns.

- Backup alarms are high-pitched signals that are designed to attract attention for workers who may be in the path of vehicles moving in reverse gear. While effective, backup horns tend to produce noise that is generally annoying and disturbing to nearby residents, particularly late at night. *Modifications to back-up alarms may include the use of alarms that automatically adjust to minimal, yet audible, levels (such as 5 dBA) above ambient noise levels in the area. Any modifications or alternatives to backup alarms must be* acceptable to *the* Occupation Safety and Health Administration (OSHA). *Alternatives* could include the use of infrared lighting, *strobe lights,* and/or flagmen. In addition, LMDC would explore opportunities to use quieter construction techniques and specially quieted equipment will be specified where feasible and effective.

- For the Proposed Action, pile driving is not anticipated since the foundations would be constructed directly on bedrock at the bottom of bathtub. Nevertheless, LMDC has committed to avoid the use of impact pile driving methods where possible. If necessary and practical, bored or augured piles will be utilized instead; where piles must be driven, vibratory, sonic, or other pile drivers that introduce slightly lower noise levels than impact pile drivers would be used where practical. In all cases, however, pile-driving operations would produce intrusive and annoying noise levels that would exceed construction impact criteria. Pile-driving operations would not occur at night, although it is possible that certain activities needed to support pile-driving (such as drilling) could occur during nighttime hours under certain circumstances.

It should be noted, however, that, especially for such complex construction as that proposed in Lower Manhattan, alternative construction methods and mitigation measures require evaluation of other factors including impacts to schedule and project cost considerations. If alternative construction methods result in schedule conflicts or delays, overall construction duration and exposure to construction noise could be extended, and the issue of whether to follow that course could be addressed when the question arises.

Overall, the types of noise mitigation that would be implemented at or adjacent to the Project Site would vary depending on the type and extent of construction and its proximity to sensitive uses (such as residences). Consequently, noise mitigation measures cannot be applied on a “one size fits all” basis, but must instead be tailored to the specific situation at each location.

For each site, the noise control plan will include an inventory of all equipment and its associated noise levels; prediction of construction noise levels (which take account of ambient noise levels, the types of construction activities, percent of time in operation, and the time of day in operation); establishment of distances between receptors and noise sources; and finally, a description of the various noise reduction measures that could be used to meet the construction noise limits that would be imposed on the contractors. A list of possible measures specific to the Proposed Action is provided below in Table 22-5.

Table 22-7
Overview of Noise Impacts and Mitigation of Construction Activities in 2006 for Various Components and Locations

Construction Activities	Possible Locations	Types of Activities		Typical Equipment Utilized	Typical Time of Operation	Duration	Airborne Noise Impact	Typical Equipment Noise Emission Levels (dBA)	Mitigation Measures
Utility Relocation	On the Perimeter of the Project Site, including Vesey and Liberty Streets, Southern Site, and Site 26	Pavement breaking, excavation of spoils, reinstallation of utilities	On surface	Pavement breaker, jack hammers, hydraulic excavator, rubber tire loader, backhoe, concrete saws, grinders, welding machines	10 hrs between 7:00 and 6:00	various	S(Work could occur during late night hours to avoid severe traffic disruptions)	88 dBA	Fit jackhammers, air compressors, generators, light plant and cranes with silencers; Use noise tents/ enclosures around workers using jackhammers; Setup temporary barrier e.g. wood panels on top of Jersey barrier.
Demolition	6 WTC, 130 Liberty Street	De-Construction to Bottom of Bathtub and/or Street Level	On surface, Northwest corner of the Bathtub	Concrete saws, impact hammers, and small track-mounted backhoe	10 hrs between 7:00 and 6:00	various	S	90 dBA	Work would not occur late night; Use of temporary noise barriers/curtains/ enclosures (Timber panel on top of Jersey barriers) and/or other mitigation measures
Sub-grade Excavation and Lateral Earth Retention	East of the 1/9 IRT line	Slurry Wall	On surface	Slurry Plant/mixing plant, Desanding plant, Crawler crane with clam shell, Forklift, Concrete pump, Trucks, Loader	10 hrs between 7:00 and 6:00	Various	S (slurry wall will reduce noise and vibration vs. pile driving)	93 dBA	Work would not occur late night; Use of temporary noise barriers/curtains/ enclosures (Timber panel on top of Jersey barriers) and/or other mitigation measures
	South of Liberty Street.	Lateral Earth Retention System	On slurry wall surfaces below grade	Pile drill rigs	10 hrs between 7:00 and 6:00		S	85 dBA	Work would not occur late night; Noise enclosures and/or other mitigation measures would be employed.
		Excavation/sub grade construction	Below grade in Bathtub	Crane, Trucks, Hydraulic excavator, Dozer, Welding machine	10 hrs between 7:00 and 6:00		NS (majority of the activities will be below grade)	85 dBA	None Required
		Misc. Machinery Use	Below grade in Bathtub		10 hrs between 7:00 and 6:00		NS	85 dBA	None Required

Table 22-7 (cont'd)
Overview of Noise Impacts and Mitigation of Construction Activities in 2006 for Various Components and Locations

Construction Activities	Possible Locations	Types of Activities		Typical Equipment Utilized	Typical Time of Operation	Duratio n	Airborne Noise Impact	Typical Equipment Noise Emission Levels (dBA)	Mitigation Measures
High Rise Office Tower Construction	Construction of five high-rise commercial office towers that will reinstate over 10 million square feet of office space on the site	Foundation and super-structure	Above Ground Below grade	Cranes, Concrete pump, Trucks, Generators, Tractor trailer, etc.	10 hrs between 7:00 and 6:00	various	S	88 dBA	Work would not occur late night; Noise curtains of side of the structure/ sheds/enclosures would be employed.
Sub-grade Construction	WTC site	Spread footing foundation	Below grade in Bathtub	Crane, Air compressor,	10 hrs between 7:00 and 5:00	Various	S	88 dBA	Work would not occur late night; Noise curtains of side of the structure/ sheds/enclosures would be employed.
		Steel Erection	Below grade in Bathtub	Crane, High lift, Tractor trailer, welding machines	10 hrs between 7:00 and 6:00		S	88 dBA	
		floors	Below grade in Bathtub	High lift	10 hrs between 7:00 and 5:00		S	85 dBA	
Surface Finishes	Memorial and Parks	Landscaping and roadwork	On surface	Loaders, dump trucks, backhoes, dozers	10 hrs between 7:00 and 5:00	various	S	85 dBA	Work would not occur late night; Noise curtains of side of the structure/ sheds/enclosures would be employed.
Tunneling	Beneath 1/9 IRT Line	Grout Improvement immediately beneath the tracks/underpinning	Underground	Grout drills, grout pumps	late at night or on weekends to avoid disturbing subway operations	Various	NS (majority of the activities will be underground and covered by road deck)	NA	None Required
		Mining/tunneling	Underground	Tunnel road header	10 hrs between 7:00 and 5:00		NS (majority of the activities will be underground and covered by road deck)	NA	None Required
		Spoil Removal	Below grade in Bathtub	Crane, Trucks, Loader	10 hrs between 7:00 and 5:00		NS (majority of the activities will be underground and covered by road deck)	NA	None Required
		Concrete Pours	Underground	Concrete pump	10 hrs between 7:00 and 5:00		NS (majority of the activities will be underground and covered by road deck)	NA	None Required
		Welding/Piling	Underground	Welding Machines	10 hrs between 7:00 and 5:00		NS (majority of the activities will be underground and covered by road deck)	NA	None Required

Table 22-7 (cont'd)
Overview of Noise Impacts and Mitigation of Construction Activities in 2006 for Various Components and Locations

Construction Activities	Possible Locations	Types of Activities		Typical Equipment Utilized	Typical Time of Operation	Duration	Airborne Noise Impact	Typical Equipment Noise Emission Levels (dBA)	Mitigation Measures
Spoil Removal by Truck	Demolish and Sub grade excavation sites, staging areas, truck routes excavation sites	Trucks traveling to and from sites, Loading and Unloading	Mostly below grade in Bathtub	Trucks, Loader	10 hrs between 7:00 and 5:00	Various	S (Significant noise impact where loading and unloading takes place; no significant noise impact on road/river network)	88 dBA	Work would not occur late night; 2 cy of soil will be placed in truck body prior too loading excavated material to replace rock impact noise
Staging Area	WTC site	Slurry plants, loading/unloading, storage	Below grade in Bathtub	Slurry Plant/mixing plant, Desanding plant, Crane, Forklift, Concrete pump, Trucks, Loader	10 hrs between 7:00 and 5:00	various	S	85 dBA	Fit crane with silencer; Use of flagmen or manually adjustable alarms to reduce back-up alarm noise; Noise enclosures and/or other mitigation measures would be employed.
	Streets and sidewalk		On surface	Concrete pumps, loads, cranes, etc.	10 hrs between 7:00 and 5:00	various	S	85 dBA	

Notes:
S- Significant for noise and/or vibration;
NS- Not significant for noise and/or vibration;
Source: The Louis Berger Group, Inc., 2003